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—OF THE—

BALTIMORE POLYTECHNIC  
INSTITUTE

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1911-1912







ANNUAL REGISTER

—OF THE—

# Baltimore Polytechnic Institute

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311-331 COURTLAND STREET

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TWENTY-SEVENTH  
ACADEMIC YEAR

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1911-1912

PRESS OF  
MEYER & THALHEIMER  
1912

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# BALTIMORE POLYTECHNIC INSTITUTE.

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## HISTORICAL SKETCH.

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The Baltimore Polytechnic Institute, the second manual training school established in the United States as a part of a public school system, is one of the several educational institutions of the secondary grade maintained by the City of Baltimore.

Although it is believed that tentative efforts to engraft manual training upon the city's school system were made as early as 1873 or 1874, yet the action which led to the establishment of this school was not taken until April, 1883. At a meeting of the Board of Commissioners of Public Schools, held on the 24th of that month, Mr. Joshua Plaskitt, Commissioner for the Ninth Ward, offered a resolution for the appointment of a committee "to consider . . . the advisability of establishing a school or schools for manual training." The resolution was adopted, and the committee thus appointed recommended the establishment of a school "for manual education." The necessary enabling ordinances and enactments having been passed by the City Council of Baltimore and the General Assembly of Maryland, the school was organized and opened on February 26th, 1884, under the name of "Baltimore Manual Training School," with Dr. R. Grady as Director.

In January, 1886, the faculty was reorganized, Lieut. John D. Ford, an officer of the Engineer Corps of the United States Navy, who had been detailed for duty at the school, becoming Principal.

From the opening of the school applicants for admission had been required to pass through the eighth grammar school grade, or to show satisfactory evidence of having had equal instruction; but in September, 1888, it was decided to admit pupils of the sixth, seventh and eighth grammar grades. This action opened the school to so large a num-

ber of young boys that increased accommodations became imperative, and in June, 1890, a new building, devoted to the academic studies and drawing, was finished and occupied.

Lieut. Ford was recalled to the naval service in June, 1890, and was succeeded as Principal by John W. Saville, a retired member of the Engineer Corps of the Navy.

In May, 1893, the name of the school was changed to "Baltimore Polytechnic Institute," and the title of Principal and Vice-Principal to President and Vice-President respectively.

Mr. Saville resigned in August, 1899, and was succeeded as President by Lieut. William R. King, Engineer Corps, U. S. N., the present head of the school.

The new charter of Baltimore, which went into effect on March 1st, 1900, provides that the Mayor of the city shall appoint, as the head of the Department of Education, a Board of School Commissioners composed of nine persons, to serve without pay, and to be chosen from among those citizens he deems "most capable of promoting the interests of public education by reason of their intelligence, character, education, or business qualifications." The names of the distinguished citizens now serving as Commissioners will be found on page 10.

Another provision of the charter requires that "in order to secure the continuance of local interest in, and oversight of the public schools, there shall be appointed by said Board of School Commissioners such number of unpaid School Visitors as may be found requisite."

The members of the original Board of Visitors had no sooner acquainted themselves with the general conditions prevailing in the school—the age and attainments of the pupils of the lower grades, the character of the work done, and the scope of the curriculum—than they submitted to the Board of School Commissioners a very comprehensive and exhaustive report discussing the conditions, needs, and aims of the school, and recommending certain changes in the requirements for admission, and in the curriculum.

The partial adoption of this report in September, 1900, excluded grammar school pupils from the Institute, thus making the standard for admission the completion of the course prescribed for the elementary schools.

In April, 1901, a further consideration of the report of the Board of Visitors led to the practical addition of one year to the course by permitting graduates to remain for a year of post-graduate work; and in May, 1902, the length of the course was, by action of the Board, set at four years for pupils entering on and after September 15, 1902.

It was further provided that pupils leaving the Institute before the completion of the course should receive certificates of the work done by them up to the time of their withdrawal.

By operation of the new charter the titles of President and Vice-President were changed, in 1900, to Principal and Vice-Principal.

The enrollment becoming greater than the buildings on Courtland street could accommodate, No. 46 Grammar School on Division street was fitted as an annex in 1908, and in September of that year the first-year class was there accommodated.

In order to provide for the continued growth of the Institute, the City Council, by an ordinance approved April 19, 1909, directed the Mayor, the City Comptroller, and President of the Board of School Commissioners to acquire by purchase the property on North avenue then occupied by the Maryland School for the Blind. That property, containing nearly six acres, was subsequently purchased for \$345,000, and plans were instituted for the erection of a building to provide for an ultimate accommodation of 2,000 pupils.

The main building on the North avenue property, formerly the Maryland School for the Blind, having been altered in accordance with the architect's plans for the new Institute, the first-year class was moved there from the Division street annex on December 5, 1910.

On March 17, 1911, ground was broken on the North avenue site for a new institute, to accommodate 1,500 students.

## BOARD OF SCHOOL COMMISSIONERS.

---

THOMAS McCOSKER, *President*,  
JAMES M. DELEVETT,  
ALBERT T. CHAMBERS,  
HENRY JOESTING, JR.,  
SIDNEY P. THANHOUSER,  
EDWARD ROSSMANN,  
HOWARD M. EMMONS,  
RICHARD J. BIGGS,  
ALBERT L. FANKHANEL.

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### BOARD OF VISITORS.

ABRAM H. COLMARY, *Chairman*,  
FREDERICK W. WOOD,  
FREDERICK J. MAYER,  
JAMES L. MURRILL,  
WILLIAM H. ROTHROCK,  
MENDES COHEN,  
FREDERICK H. WAGNER.

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### SUPERINTENDENT OF PUBLIC INSTRUCTION.

FRANCIS A. SOPER.

## RECORD OF THE FACULTY AND STAFF.

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ARRANGED IN ORDER OF APPOINTMENT.

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William R. King, Passed Assistant Engineer, U. S. N. (retired), U. S. N. A., 1875. Principal and Head of Department of Engineering, September 1, 1899; relinquished duties of Head of Department of Engineering, September, 1911.

William H. Hall, B. C. C., 1885; A.M., Washington College, 1906. Assistant in Department of Science, September 23, 1886; Head of Department of Science, September 13, 1899; Vice-Principal, January 1, 1912.

William G. Richardson. Assistant in Department of Engineering, February, 1887.

J. Ward Willson, B. C. C., 1861; M.D., Baltimore University, 1889. Assistant in Department of English and Modern Languages, March 21, 1889.

George M. Gaither, B. M. T. S., 1888. Assistant in Department of Engineering, April 1, 1889; Supervisor of city manual training centers in addition to Institute duties, September, 1902.

Samuel M. North, B. C. C., 1887. Assistant in Department of Mathematics, September, 1894; Head of Department of English and Modern Languages, September 13, 1899; on leave of absence, 1911-1912.

Samuel P. Platt. Assistant in Department of Engineering, October 1, 1897.

Oliver Bacharach, B. C. C., 1897. Assistant in Department of Mathematics, April, 1898.

J. Edward Broadbelt, B. M. T. S., 1890; Ph.G., Maryland College of Pharmacy, 1893. Assistant in Department of Science, September, 1898.

J. Montgomery Gambrill, B. P. I., 1897. Assistant in Department of English, June 11, 1902; resigned in 1904 to become Assistant State Superintendent of Education in Maryland; Head of Department of History and Civics, September, 1906.

Charles Ernest Conway, B. P. I., 1902. Assistant in Department of Engineering, June 11, 1902; at Lehigh University, 1903-1904; Assistant in Department of Engineering, 1904-1905; Assistant in Department of Engineering, September, 1907; Head of Department of Engineering, February 1, 1912.

William L. DeBaufre, B. P. I., 1903; E.E., Lehigh University, 1907; M.E., Lehigh University, 1909. Assistant in Department of Engineering, September, 1903; at Lehigh University, 1904-1905; Assistant in Department of Engineering, 1905-1906; at Lehigh University, 1906-1907; Assistant in Department of Engineering, January 1, 1908; Head of Department of Engineering, September 1, 1911; resigned, January 31, 1912.

Irving L. Twilley, A.M., Washington College, 1892. Assistant in Department of English, September, 1903; transferred to Department of Science, June, 1904.

Henry A. Converse, A.B., Hampden-Sidney College, 1893; Ph.D., Johns Hopkins University, 1903. Assistant in Department of Mathematics, May, 1904; resigned, September 1, 1906, to accept the chair of Mathematics at Davis and Elkins College; Assistant in Department of Science, June, 1908; Acting Head of Department of Mathematics, February 10, 1909; Head of Department of Mathematics, September, 1909.

Edward Reisler, A.M., Western Maryland College, 1888. Assistant in Department of English, May, 1904.

Elmer M. Harn, A.B., Rock Hill College, 1892; A.M., Rock Hill College, 1895. Assistant in Department of English, July, 1904.

Isaac L. Otis, A.B., New York University, 1899. Assistant in Department of English, September, 1904; Assistant in Department of History and Civics, September, 1906.

Allen L. Malone, B. P. I., 1902; at Cornell University, 1902-1903 and 1903-1904. Assistant in Department of Engineering. October 1, 1904.

Allan B. Souther, B.S., Harvard, 1897. Assistant in Department of Engineering, October, 1905.

Harvey S. Houskeeper, A.B., Lehigh University, 1872. Assistant in Department of Mathematics, September, 1906.

Henry Bogue, Jr., A.B., Johns Hopkins University, 1899. Assistant in Department of Engineering, September, 1906.

Thomas F. Garey, A.B., Washington College, 1904; A.M., Washington College, 1907; LL.B., University of Maryland, 1907. Assistant in Department of Mathematics, November, 1906.

George S. Wills, Ph.B., University of North Carolina, 1896; A.M., Harvard, 1898. Assistant in Department of English, June 3, 1907; Acting Head of Department of English and Modern Languages, September 1, 1911.

William H. Wilhelm, A.B., B.S., St. John's College, 1893; A.M., St. John's College, 1896. Assistant in Department of Mathematics, June 12, 1907.

James B. Arthur, B. P. I., 1904. Assistant in Department of Science, September 25, 1907.

William P. Stedman, A.B., Trinity College, 1905. Assistant in Department of English and Modern Languages, February 12, 1908.

Joseph Ellis Hodgson, A.B., Washington and Lee, 1898; Ph.D., Johns Hopkins University, 1910. Assistant in Department of Mathematics, June, 1908.

John H. Hills, B. P. I., 1905; M.E., Lehigh University, 1908. Assistant in Department of Engineering, June, 1908.

Emanuel Fritz, B. P. I., 1905; M.E., Cornell University, 1908. Assistant in Department of Engineering, June, 1908.

Charles Frederick Ranft, A.B., Johns Hopkins University, 1902. Assistant in Department of History and Civics, June, 1908.

Philip Dougherty, B.S., Trinity College, 1907; A.M., Columbia University, 1909. Assistant in Department of History and Civics, June, 1908.

George N. Anderson, Pratt Institute, 1908. Assistant in Department of Engineering, September, 1908.

Nathan Lebovitz. Secretary, February 11, 1909.

Clarence P. Bolgiano, B. P. I., 1908. Laboratory Assistant, September, 1909; Assistant in Department of Engineering, February 1, 1912.

Wilson N. Gambrill, B. P. I., 1909. Graduate Assistant in Department of Engineering, September, 1909; at Lehigh University, 1910-1911; Assistant in Departments of Engineering and Mathematics, September 1, 1911.

Laurance F. Magness, B. P. I., 1907. Assistant in Department of Engineering, September, 1909.

Alfred B. Haupt, B. C. C., 1906; A.B., Johns Hopkins University, 1909. Assistant in Department of Mathematics, October, 1909.

George H. Schwartz, B. C. C., 1905; A.B., Johns Hopkins University, 1908. Assistant in Department of English, September, 1910.

Lloyd Barrick, A. B., Columbia University, 1905. Assistant in Department of English, February, 1911.

Harry C. Gossard, B.S., Ohio Northern University, 1907. Substitute in Department of Mathematics, February, 1911.

Walter F. Shenton, B.S., Dickinson College, 1907; A.M., 1909. Substitute in Department of Mathematics, September, 1911.

L. Chase Wright, B. P. I., 1908; C.E., Lehigh University, 1911. Assistant in Department of Engineering, September, 1911.

Harry C. Finck, B. P. I., 1906. Assistant in Department of Engineering, September, 1911.

W. W. Baden, A.B., Johns Hopkins University, 1881; Ph.D., 1892. Substitute in German, September, 1911.

W. Elwood Vail, B. P. I., 1911. Graduate Assistant in Department of Engineering, September, 1911.

Howard H. Elliott, B. P. I., 1911. Graduate Assistant in Department of Engineering, September, 1911; Laboratory Assistant in Department of Science, February 1, 1912.

Owens Laws, B. P. I., 1911. Graduate Assistant in Department of Engineering, January, 1912.

Taylor Starck, A.B., Johns Hopkins University, 1911. Substitute in Department of English, January 1, 1912.

Julius Zieget, B. P. I., 1907; C.E., Cornell University, 1910. Assistant in Department of Engineering, February 1, 1912.

J. Vinton Hobbs, B. C. C., 1894; M. S. N. S., 1897; Columbia University Summer School, 1907-1908-1909. Assistant in Department of Science, February 1, 1912.

Charles E. Adams, B. C. C., 1898; intermittent work at University of Chicago, 1906-1911. Assistant in Department of English, March 1, 1912.

## FACULTY.

---

WILLIAM R. KING,  
Principal.

WILLIAM H. HALL,  
Vice-Principal,  
Head of Department of Science.

SAMUEL M. NORTH,  
(On leave of absence)  
Head of Department of English and Modern Languages.

GEORGE S. WILLS,  
Acting Head of Department of English and Modern Languages.

J. MONTGOMERY GAMBRILL,  
Head of Department of History and Civics.

HENRY A. CONVERSE,  
Head of Department of Mathematics.

CHARLES E. CONWAY,  
Head of Department of Engineering.

NATHAN LEBOVITZ,  
Secretary.

## FACULTY AND STAFF BY DEPARTMENTS.

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### DEPARTMENT OF ENGINEERING.

CHARLES E. CONWAY, *Head of Department.*

JOHN H. HILLS,  
SAMUEL P. PLATT,  
HENRY BOGUE, JR.,  
ALLAN B. SOUTHER,  
WILLIAM G. RICHARDSON,  
EMANUEL FRITZ,  
ALLEN L. MALONE,  
GEORGE M. GAITHER,  
GEORGE N. ANDERSON,  
LAURANCE F. MAGNESS,  
L. CHASE WRIGHT,  
HARRY C. FINCK,  
W. ELWOOD VAIL,  
OWENS LAWS,  
CLARENCE P. BOLGIANO,  
JULIUS ZIEGET.

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### DEPARTMENT OF MATHEMATICS.

HENRY A. CONVERSE, *Head of Department.*

OLIVER BACHARACH,  
WILLIAM H. WILHELM,  
HARVEY S. HOUSKEEPER,  
THOMAS F. GAREY,  
JOSEPH E. HODGSON,  
ALFRED B. HAUPT,  
HARRY C. GOSSARD,  
WALTER F. SHENTON,  
WILSON N. GAMBRILL.

**DEPARTMENT OF SCIENCE.**

WILLIAM H. HALL, *Head of Department.*

J. EDWARD BROADBELT,  
IRVING L. TWILLEY,  
JAMES B. ARTHUR,  
J. VINTON HOBBS,  
HOWARD H. ELLIOTT.

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**DEPARTMENT OF ENGLISH AND MODERN LANGUAGES.**

GEORGE S. WILLS, *Acting Head of Department.*

J. WARD WILLSON,  
EDWARD REISLER,  
ELMER M. HARN,  
WILLIAM P. STEDMAN,  
GEORGE H. SCHWARTZ,  
LLOYD BARRICK,  
W. W. BADEN,  
TAYLOR STARCK,  
CHARLES E. ADAMS.

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**DEPARTMENT OF HISTORY AND CIVICS.**

J. MONTGOMERY GAMBRILL, *Head of Department.*

ISAAC L. OTIS,  
CHARLES F. RANFT,  
PHILIP DOUGHERTY.

## CALENDAR FOR SCHOOL YEAR 1911-1912.

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September 13, Wednesday.....	Opening of Session.
November 17, Friday.....	First Quarter ends.
November 20, Monday.....	Second Quarter begins.
November 30, Thursday.....	Thanksgiving Day.
December 22, Friday.....	Christmas Vacation begins.
January 3, Wednesday.....	Session resumed.
January 19, Friday.....	Semi-annual Examinations begin.
February 9, Friday.....	Second Quarter ends.
February 12, Monday.....	Third Quarter begins.
February 22, Thursday.....	Washington's Birthday.
March 29, Friday.....	Third Quarter ends.
April 1, Monday.....	Fourth Quarter begins.
April 4, Thursday.....	Easter Vacation begins.
April 9, Tuesday.....	Session resumed.
April —, Friday.....	Arbor Day.
May 22, Wednesday.....	Annual Examinations begin.
May 30, Thursday.....	Decoration Day.
June 18, Tuesday.....	Commencement Day.
September 16, Monday.....	Opening of Session.
November 22, Friday.....	First Quarter ends.
November 25, Monday.....	Second Quarter begins.
November 28, Thursday.....	Thanksgiving Day.
December 24, Tuesday.....	Christmas Vacation begins.

## COURSE OF STUDY AND GENERAL STATEMENT OF PLAN AND PURPOSE.

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The course of study for the Baltimore Polytechnic Institute is designed to accomplish the following purposes:

1. To give a sound fundamental education to pupils whose inclinations and other circumstances preclude a college course.
2. To give to youth that healthful and highly valuable manual training which broadens education, and conduces to dexterity, contrivance, and invention.

To this end, the time usually devoted to Greek and Latin is employed, during two years of the course, in carpentry, sheet-metal, and light forge exercises. The exercises cover what is known as Manual Training, and are given with special reference to their educational value.

3. To give to students in the third and fourth years such studies in Engineering, Mathematics, Physics, and Chemistry, and such mechanical exercises in Applied Manual Training as will fit them:

(a) For immediate and remunerative employment in the wide field of civil, mechanical, and electrical engineering, where, it is believed, their training will lead to rapid advancement.

(b) For entrance to advanced standing into a higher institution of technology, should a higher technical education be desired.

For the attainment of these objects there is one carefully planned general course of study, no effort being made to specialize until the fourth year, by which time a student will have acquired a considerable degree of practical skill and intimate knowledge in some one of the professions based on mechanical art and applied science that he may have elected to follow. Thus, in the fourth year in the subject of Design, the student may select examples of mechanical, electrical, or civil engineering design, the amount of such practice

being limited only by the capacity of the student and the time available. Extra opportunities in the laboratories are offered advanced students for more extended investigations than those demanded by the course.

No attempt is made to teach trades, but the equipment is of such nature that the instruction given in the shops is designed to be correlative to the work of the classroom, and results are aimed at that will insure success in mechanical pursuits subsequent to graduation. It is believed that instruction in correct methods of using tools, and practical illustrations of how, and for what purpose, things are done, are of more value than mere excellence in hand skill.

In the department of English and German, instruction in English is given throughout the four years, and in German throughout the first three. The course in English comprises the theory and practice of composition and the reading and study of selections from representative British and American authors, including the college entrance requirements. The work in composition is designed to give the student a practical knowledge of the ordinary forms of discourse and to train him in expressing his thoughts with ease and accuracy. To this end he is given frequent exercise in writing, the subjects, for the most part, being taken from his daily experience and from his work in the other departments of the school. The course in literature is designed, not only to meet the college entrance requirements, but to cultivate in the student such tastes as will lead him in his reading to choose books that are worth while.

The course in German comprises drill in the fundamental principles of grammar, and as wide a reading as is possible in selected texts. The course is not designed to give a speaking knowledge of the language, but such knowledge as will enable the pupil to read German easily, and successfully to pursue advanced courses in the study of the language.

In the Department of History and Civics, instruction is given during the first and second years. The course in-

cludes about one-half the work prescribed by the Committee of Seven, the first year being devoted to English History, and the second year to American History and Civics.

In Mathematics, care is taken at the beginning of the first year to discover and correct any defects in fundamental training, after which the course of instruction proceeds in Algebra, Geometry, Trigonometry, Analytic Geometry, Descriptive Geometry, and the Differential and Integral Calculus, the completeness of the course enabling the graduate to read understandingly a treatise on any of the mechanical sciences.

In the Department of Science, the work of the second and third years in Physics embraces the properties of matter and elementary mechanics, the instruction being accompanied with lectures illustrated by experiments and with practical work in the laboratory. The instruction of fourth-year students in this subject is confined to Heat and Electricity. The dynamic theory of heat, the conversion of heat into mechanical work, and the thermo-dynamics of the steam engine are the particular features of the fourth year in the study of Heat.

In Electricity, the work of the fourth year consists of practical applications of the theoretical study of the second and third years, and of commercial electricity. Electric lighting, both arc and incandescent, is discussed from constructive and economic standpoints, and the advantages of high tension distribution of electric power are demonstrated. The dynamo and motor are treated in detail—operating, designing, and winding being carefully considered. The experimental equipment for this work consists of a twenty-five kilowatt generator, built by the students; a one-half horsepower alternating current motor coupled to a twenty-five volt multipolar generator; and several small machines of various types. These appliances, with the electric light equipment of the Institute, present opportunities for the operation of electrical machinery and for the detection of defects and faults to be overcome. Alternating currents are treated both mathematically and experimentally, and converters, motors, impedance coils, and measuring instruments are used by students for verifying

laws and descriptions given in lectures. The switchboard and the generator plant afford opportunities for power station practice, and the electric railway is treated in a practical manner. The newest and best methods of telegraph and telephone construction are presented, the telephones of the Institute being installed on the common battery plan. Special features of the course are the various tests for insulation resistance of conductors, the tests for grounds, faults and short circuits on lines, and the treatment of the defects in the dynamo and motor, and remedies therefor.

For the study of Chemistry there are chemicals and apparatus in the laboratory to give to the third year students instruction concerning the nature and reaction of the chemical elements and their compounds, and to students of the fourth year a brief course in qualitative and quantitative analysis, the compounds formed in the various reactions and their chemical equations being particularly emphasized.

In the Department of Engineering, the instruction given the fourth year students in theoretical and applied mechanics embraces the laws of equilibrium and motion; center of gravity; friction; principles of work; moment of inertia; mechanics of materials; graphic methods of determining stresses in beams and framed structures; and an elementary study of the stresses and deformations produced in standard specimens of metal when subjected to tension, compression, and shearing. The work of the third and fourth year students in steam engineering consists of the study of thermo-dynamics of the steam engine in a manner as comprehensive as the facilities of the Institute and the maturity of the students permit. Numerous calculations are made involving engine and boiler efficiencies and proportions, and the study of the indicator is supplemented with practice in taking diagrams, from which the consumption and distribution of the steam and the power of the engine are determined. The advantages and disadvantages of the different kinds of steam boilers are studied, particular attention being given to boiler attachments. The plant for this work consists of an inverted triple expansion engine of

100 I. H. P., an inverted compound engine of 60 I. H. P., a high-speed automatic cut-off engine (Harrisburg Standard) of 46 I. H. P., a horizontal power engine of 25 I. H. P., a 30 H. P. gasoline engine of the Autocar type, a Campbell & Zell sectional boiler (rated at 100 horsepower), and a Roberts safety water tube boiler, capable of generating steam for the production of 120 I. H. P. when used in connection with the triple expansion engine. The engines mentioned above were built by the students, the first two after designs of the Bureau of Steam Engineering of the Navy Department. Grouped in the mechanical laboratory are all the engines, the 25 K. W. generator, the switchboard controlling the lighting installation of the Institute, a Riehle testing machine of 50,000 pounds capacity, and apparatus for calibrating pressure gauges, thermometers, and indicator springs. The compound and triple expansion engines may be worked singly or together in connection with a friction dynamometer specially designed at the Institute, an internal circulation of water in the brake wheel enabling the engine to run continuously in making power tests. The Roberts boiler is installed in a room immediately connected with the laboratory, and furnishes steam at 150 pounds pressure per square inch for the stage expansion engines, and at 95 pounds and 40 pounds to the high-speed and power engines, respectively, Foster regulators reducing the pressure as desired. Horizontal and vertical separators are placed in the steam pipes to insure the delivery of dry steam to the engines, and connections are made for calorimeter tests. The surface condenser used in connection with the stage expansion engines may also be connected with the exhaust of the high-speed engine when desired. The water from condensation is delivered to a filter of approved design by a Knowles independent air pump, and thence direct to the boiler either by a Knowles duplex pump or Pemberthy injector. Exhaustive engine and boiler tests for power and efficiency

are made by squads of fifteen of the senior class, the results of which are recorded in standard forms and retained by the students.

In the mechanical drawing room are 195 tables of approved design, and an equipment of instruments and models well adapted to the requirements of an advanced course in the subject. Third year students are required to make a free-hand sketch of the parts of some machine, from which a finished drawing, tracing, and blue print are made. The work of the fourth year students in design tends to make them draftsmen in the true sense—not mere copyists.

The equipment in the machine, pattern, forge, sheet metal, and carpentry shops is equal to that of any similar institution in the country.

## THE COURSE OF INSTRUCTION IN DETAIL.

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The course extends over a period of 36 effective weeks of instruction, and as here outlined in detail applies to all entries after January 31, 1910, though the students in the Institute who entered previous to that date are pursuing an equivalent course. It is believed that the new arrangement will be more effective, as it advances the modern languages one year, that is, to the first, second, and third years from the second, third, and fourth; and concentrates physics in the second and third years in preference to distributing the subject through the first, second, and third years.

Students completing the full course of the Institute have invariably obtained full sophomore standing with some sophomore credits in the courses leading to the degrees of C.E., M.E., and E.E., at Cornell and Lehigh Universities.

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### DEPARTMENT OF ENGINEERING AND APPLIED MECHANICS.

#### FIRST YEAR COURSE — D CLASS.

*Mechanical Drawing.*—36 weeks, 4 periods a week:

Use of instruments; lettering; elementary lessons.

*Practice.*—36 weeks, 4 periods a week:

(a) Carpentry; 18 weeks, 4 periods a week:

Lectures and exercises in laying out, cutting, framing, and joining wooden members.

(b) Sheet Metal; 18 weeks, 4 periods a week:

Lectures and exercises in soldering, and in sheet metal and venetian iron work.

#### SECOND YEAR COURSE — C CLASS.

*Mechanical Drawing.*—36 weeks, 4 periods a week:

Hatching; tinting; neatness and accuracy; scale drawing; intersection and development of surfaces.

*Practice.*—36 weeks, 4 periods a week:

(a) Carpentry; 5 weeks, 4 periods a week:

Review of the work of the first year.

(b) Pattern Making; 13 weeks, 4 periods a week:

Exercises in wood turning and in making simple patterns.

- (c) Forge Work; 9 weeks, 4 periods a week:  
Light forging and welding.
- (d) Vise Work; 9 weeks, 4 periods a week:  
Exercise in chipping and filing.

### THIRD YEAR COURSE — B CLASS.

*Steam Engineering.*—36 weeks, 4 periods a week:

Types of boilers; boiler details; boiler room auxiliaries; the steam engine; engine details; indicating and governing; governors; valves; condensers; multiple expansion engines; theories of heat; thermodynamics; properties of perfect gases; properties of saturated steam; use of steam tables; combustion of fuel and steam generation; boiler and engine efficiencies; the engine mechanism; slide valve and link motion.

*Mechanical Drawing.*—36 weeks, 4 periods a week:

Detail drawings of machines from free-hand sketches; the working drawing, tracing and blue print. Descriptive Geometry (see course in Mathematics).

*Practice.*—36 weeks, 4 periods a week:

- (a) Pattern Shop; 18 weeks, 4 periods a week:  
Exercises in making patterns for wrenches, pulleys, eccentrics, pillow-blocks, gears, globe valves, pipe joints, and core boxes where necessary. Lectures on construction and finish of patterns, and on the different kinds of molding, the mixing of iron and brass, and the operation of the cupola.
- (b) Machine Shop; 15 weeks, 4 periods a week:  
Casehardening, and work on the lathe, planer, milling machine, drill-press, and vise.
- (c) Forge Shop; 3 weeks, 4 periods a week:  
Forging and tempering machine cutting tools.

### FOURTH YEAR COURSE — A CLASS.

*The Steam Engine.*—22 weeks, 3 periods a week:

The indicator and indicator diagram; measurement of power and of steam consumption; expansion of perfect gases and of steam; the ideal and actual engine; engine and boiler design; valve diagrams; engine and boiler testing; the steam turbine.

*The Internal Combustion Engine.*—14 weeks, 3 periods a week:

Gaseous fuels; oil engines; types of explosive engines; operation and management of the explosive engine.

*Mechanics.*—18 weeks, 5 periods a week:

Kinematics: Motion in a straight line with constant velocity and with constant acceleration; space, velocity and acceleration curves;

vectors; resolution and composition of displacements, velocities, and accelerations; relative motion; acceleration with variation in direction of velocity; angular motion.

Dynamics: (a) Statics: The parallelogram, triangle, and polygon of forces; composition and resolution of forces; friction; the inclined plane; the screw; parallel forces; moments of forces and of couples; conditions of equilibrium; method of sections; equilibrium under the action of three forces; centre of gravity. (b) Kinetics: The laws of motion; inertia, mass, weight, momentum; work and power of a force and of a torque; potential and kinetic energy; principles of work; centrifugal and centripetal forces.

*Mechanics of Materials.*—18 weeks, 5 periods a week:

Stress, strain, elastic limit, ultimate strength; calculations involving bending and resisting moments, moment of inertia, radius of gyration, deflection and resilience of simple and cantilever beams and of columns and shafts; bending moment and shear diagrams.

Graphic methods of determining stresses in beams and framed structures by means of the funicular polygon and reciprocal diagram.

Mechanics of Machinery: Transmission of power by means of belts and toothed gears; theory and action of pumps.

*Mechanical Drawing and Design.*—36 weeks, 4 periods a week:

Mechanical Drawing. The drafting accompanying the work in design; freehand sketches, working drawings, tracing, and blue prints.

Design: Proportioning of machine parts, such as spur, bevel, and worm gearing, belt pulleys, and bearings, from empirical and rational formulas. The application of the mechanics of materials to the design of some part of an engine or tool, such as cylinder, connecting rod, valve, screw jack. The use of the Zeuner diagram in valve design. The application of graphic statics to the design of a roof truss or bridge member. Students are permitted to select a subject for design from a list of mechanical and electrical devices submitted to them.

*Practice.*—36 weeks, 4 periods a week.

(a) Machine Shop; 18 weeks, 4 periods a week:

Machine work involving accuracy and finish, such as gear cutting, building and assembling of machinery.

(b) Engineering Laboratory; 18 weeks, 4 periods a week:

Tension, compression, and bending tests with a Richle machine; calibration of pressure gauges, thermometers, and indicator springs; calorimeter tests for quality of steam; valve setting; determining clearance; duty of steam pumps; indicated steam consumption of engines; economy tests of engines and boilers.

## DEPARTMENT OF MATHEMATICS.

## FIRST YEAR COURSE — D CLASS.

*Algebra.*—36 weeks, 4 periods a week:

Definitions and notation; fundamental operations; integral linear equations; factoring; highest common factor; least common multiple; fractions; fractional equations; simultaneous linear equations; graphical representation; inequalities; involution; evolution; theory of exponents; surds; quadratic equations.

*Geometry.*—36 weeks, 3 periods a week:

Geometry of the straight line and circle; proportion; properties of similar figures; original exercises.

*Explanation and Demonstration.*—36 weeks, 1 period a week:

The most difficult and important features of the course are explained and demonstrated.

## SECOND YEAR COURSE — C CLASS.

*Algebra.*—36 weeks, 3 periods a week:

Review; theory of quadratic equations; variables and limits; indeterminate equations; ratio and proportion; logarithms; variation; arithmetical, geometrical and harmonic progressions; binominal theorem; undetermined coefficients.

*Geometry.*—18 weeks, 3 periods a week, and 9 weeks, 4 periods a week:

Areas and volumes; lines and planes in space; polyhedrons; cylinder; cone; sphere; original exercises.

*Trigonometry.*—9 weeks, 4 periods a week:

Functions of the acute angle; the right triangle; use of tables; functions of any angle; relations between the functions of several angles; inverse trigonometric functions.

## THIRD YEAR COURSE — B CLASS.

*Trigonometry.*—18 weeks, 3 periods a week:

General formulas; oblique triangle; miscellaneous examples.

*Surveying.*—18 weeks, 2 periods a week:

Instruments and their uses; land surveying.

*Analytic Geometry.*—36 weeks, 4 periods a week:

The straight line; circle; parabola; ellipse; hyperbola; transformation of co-ordinates; construction of loci; higher plane curves.

*Descriptive Geometry.*—Time taken from mechanical drawing, as it is taught in connection with that subject.

Projections; problems in straight line and plane; projections and sections of solids; curved surfaces and tangent planes; development and projection of screw thread; intersection of surfaces.

## FOURTH YEAR COURSE — A CLASS.

*Differential and Integral Calculus.*—36 weeks, 5 periods a week:

Differentiation of algebraic and transcendental functions; successive differentiation; expansion of functions, including the development of Maclaurin's and of Taylor's theorems; evaluation of indeterminate forms; mode of variation of functions of one variable, including geometric problems in maxima and minima; differentiation of functions of more than one variable; radius of curvature; tangents and normals; derivatives of arcs, areas, volumes, and surfaces of revolution; fundamental rules and methods of integration; geometrical application of the calculus to lengths of curves, to areas, to volumes of solids of revolution; integration of trigonometric functions; successive integration; applications to mechanics.

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## DEPARTMENT OF SCIENCE.

## SECOND YEAR COURSE — C CLASS.

*General Physics.*—36 weeks, 4 periods a week:

During this year the regular high school course in Physics is covered. Derivation of formulae and the solution of problems are required. Emphasis is laid upon such sections as have reference to engineering courses. Experimental demonstration by the instructor is made whenever the subject permits. One period a week is devoted to individual work in the laboratory.

## THIRD YEAR COURSE — B CLASS.

*Electricity and General Physics.*—36 weeks, 4 periods a week:

Magnetism; galvanometers and other measuring instruments; laws of electrical action; magnetic and electrical units; simple alternating currents; derivation of formulae and practical problems; experimental demonstration by the instructor; individual laboratory work in electrical measurements.

The year in physics is confined principally to advanced study of light and sound, the subjects of dynamics and heat being embraced in the work of the Department of Engineering.

*Chemistry.*—36 weeks, 2 periods a week:

Recitations in general chemistry with experimental work by the instructor, showing the preparation and reactions of the elements and compounds. Individual work in the laboratory.

## FOURTH YEAR COURSE — A CLASS.

*Electricity*.—36 weeks, 4 periods a week:

Lectures and recitations in applied electricity, including electro-chemical action; principles of the generator, motor, and transformer; railways; line and machine testing; telegraph and telephone; electric lighting. One period a week is devoted to individual laboratory work in measurements, practical testing, and the operation of the generator, motor, and transformer.

*Chemistry*.—36 weeks, 4 periods a week:

General Chemistry: Practice in stoichiometry; lectures illustrating the theory of chemical action and emphasizing the parts of the subject bearing upon engineering work.

Analytic Chemistry: Qualitative and quantitative analysis, the work of the fourth quarter consisting in the determinations of the substances affecting the quality of iron and steel.

## DEPARTMENT OF ENGLISH AND MODERN LANGUAGES.

## FIRST YEAR COURSE — D CLASS.

*Composition and Rhetoric*.—36 weeks, 2 periods a week:

Study of text and frequent written exercises based upon Narration and Description; letter writing.

*Literature*.—36 weeks, 3 periods a week:

- (a) Study of the following selections: Sketch Book; Snow Bound; Tales of the White Hills; Poems and Tales from Poe; Sir Launfal; Lays of Ancient Rome; Lady of the Lake; Ivanhoe.
- (b) Leading facts in the lives of the authors represented in (a).

*German*.—36 weeks, 4 periods a week:

Study of the grammar and reading.

## FIRST YEAR COURSE — D CLASS.

*Composition and Rhetoric*.—36 weeks, 2 periods a week:

Frequent written exercises; study of rhetorical principles.

*Literature*.—36 weeks, 2 periods a week:

- (a) Study of the following selections: Ancient Mariner; Vicar of Wakefield; Deserted Village; Silas Marner; DeCoverley Papers; Merchant of Venice; Palgrave (in part).
- (b) Leading facts in the lives of the authors represented in (a).

*German*.—18 weeks, 4 periods a week; and 18 weeks, 3 periods a week:

Composition; grammar; reading standard German fiction and simple scientific prose.

### THIRD YEAR COURSE — B CLASS.

*Literature and Composition*.—18 weeks, 2 periods a week; and 18 weeks, 3 periods a week:

Study of the following texts: Julius Caesar; Macbeth; Milton's L'Alegro, Il Penseroso, Lycidas, and Comus; Washington's Farewell Address; Webster's First Bunker Hill Oration, or Burke's Speech on Conciliation. Frequent written exercises.

*German*.—36 weeks, 3 periods a week:

Review of grammar and composition; copious reading in prose and poetry.

### FOURTH YEAR COURSE — A CLASS.

*Technical Composition*.—36 weeks, 1 period a week.

Methods of exposition, and drill in the non-technical discussion of subjects taken from the students' work in the technical departments. Frequent conferences with instructors.

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## DEPARTMENT OF HISTORY AND CIVICS.

### FIRST YEAR COURSE — D CLASS.

*History*.—36 weeks, 5 periods a week:

English History from its beginnings to the present day. Especial attention is given to the social, economic, and political phases of the subject; and as far as time and the maturity of the pupils permit, attention is directed to the development of Europe as it progressed contemporaneously with England.

### SECOND YEAR COURSE — C CLASS.

*History and Civics*.—36 weeks, 4 periods a week:

American History, with special attention to political development; civil government of the United States and the rights and duties of American citizenship.

TIME DEVOTED TO THE DIFFERENT SUBJECTS COMPRISING  
THE FOUR YEAR COURSE.

	NUMBER OF HOURS PER YEAR.				
	1st Year	2nd Year	3rd Year	4th Year	Aggregate
DEPARTMENT OF ENGINEERING					
Carpentry .....	72	20	.....	.....	92
Sheet Metal.....	72	.....	.....	.....	72
Vise .....	.....	36	.....	.....	36
Forge .....	.....	36	24	.....	60
Pattern .....	.....	52	72	.....	124
Machine .....	.....	.....	48	72	120
Mechanical Laboratory.....	.....	.....	.....	72	72
Mechanical Drawing.....	144	144	108	.....	396
Descriptive Geometry.....	.....	.....	36	.....	36
Machine Design.....	.....	.....	.....	144	144
Steam and Gas Engines.....	.....	.....	144	108	252
Mechanics .....	.....	.....	.....	90	90
Mechanics of Materials.....	.....	.....	.....	90	90
DEPARTMENT OF MATHEMATICS					
Algebra .....	144	108	.....	.....	252
Geometry .....	108	90	.....	.....	198
Geometry, Analytic.....	.....	.....	144	.....	144
Trigonometry .....	.....	36	54	.....	90
Surveying .....	.....	.....	36	.....	36
Calculus, Differential.....	.....	.....	.....	90	90
Calculus, Integral.....	.....	.....	.....	90	90
Explanation and Demonstration....	36	.....	.....	.....	36
DEPARTMENT OF SCIENCE					
Physics .....	.....	108	36	.....	144
Physics, Laboratory.....	.....	36	.....	.....	36
Electricity .....	.....	.....	72	108	180
Electricity, Laboratory.....	.....	.....	36	36	72
Chemistry, Elementary.....	.....	.....	36	72	108
Chemistry, Laboratory.....	.....	.....	36	.....	36
Chemistry, Analytic.....	.....	.....	.....	72	72
DEPARTMENT OF ENGLISH					
Composition and Rhetoric.....	72	72	.....	.....	144
Literature .....	108	72	90	.....	270
German .....	144	126	108	.....	378
Technical Compositions.....	.....	.....	.....	36	36
DEPARTMENT OF HISTORY AND CIVICS					
History .....	180	.....	.....	.....	180
History and Civics.....	.....	144	.....	.....	144
Total .....	1080	1080	1080	1080	4320

## REQUIREMENTS FOR ADMISSION.

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Pupils bearing properly attested certificates of having passed the prescribed Grammar School Course of the Public School System of Baltimore are entitled to enrollment.

Other applicants residing in the city will be admitted after passing an examination covering the requirements of the eighth grammar school grade. Eighth grade grammar school pupils who fail of promotion are not eligible for admission under this requirement. Specimen entrance examination papers covering the requirements of the eighth grade will be found on pages 67 and 68.

After having successfully passed the entrance examination, a non-resident applicant must register as such at the office of the Secretary of the Board of School Commissioners, where he will be furnished with a bill for the first quarterly installment of the annual fee of \$85, and a presentation at the Institute of a coupon from the bill, signed by the City Comptroller, will be accepted as evidence of payment, and entitle the applicant to enrollment.

## MERIT ROLLS.

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Merit rolls, showing the proficiency of students in each branch of study, are made out annually for the different classes.

Each subject is assigned a coefficient indicative of its relative weight, and the final mark of a student in a subject (on a scale of 100) is multiplied by its coefficient. The sum of the products thus obtained is the final mark of the student in all the subjects for the year. This mark is a certain percentage of the sum of the coefficients, and such percentage is the student's average for the year.

BALTIMORE POLYTECHNIC INSTITUTE.  
FOURTH YEAR RECORD AND FINAL MERIT ROLL OF THE MID-YEAR GRADUATING CLASS OF 1911.

Order of Merit.	NAMES.	Date of Admission.	Mechanics.	Mechanics Applied to Engineering.	Steam and Gas Engineering.	Mech. Drawing and Design.	Diff. and Integral Calculus.	Chemistry.	Applied Electricity.	French.	Practice.	Department.	Aggregate for 1st Year.	Aggregate for 2nd Year.	Aggregate for 3rd Year.	Aggregate for 4th Year.	Aggregate for Four Years.	Graduating Average.
	MAXIMA.		7	10	10	8	10	10	10	5	5	5	20	40	60	80	200	100
10	A. Baer.....	1906	4.90	7.50	7.00	6.32	7.00	7.30	7.00	4.00	3.65	3.75	14.19	30.42	45.06	58.42	148.09	74.05
7	I. L. Berg.....	1906	5.18	8.20	7.00	6.08	7.40	7.30	8.10	4.05	3.85	4.50	15.46	31.25	45.14	61.66	153.51	76.76
5	E. E. Hall.....	1906	5.11	7.00	7.30	6.16	7.00	7.20	7.40	3.50	4.15	4.50	15.51	32.08	47.82	59.32	154.73	77.37
6	F. H. Jones.....	1906	4.90	7.70	7.60	6.32	7.10	7.50	7.10	4.10	3.65	5.00	14.56	30.37	48.00	60.97	153.90	76.95
8	G. W. Kelly.....	1906	5.04	7.40	7.00	6.72	7.50	8.00	7.10	4.00	4.05	5.00	16.26	31.24	44.62	61.81	153.93	76.97
4	J. L. Krausz.....	1905	5.32	8.10	8.20	6.40	7.60	8.30	7.60	3.85	4.30	2.25	15.58	31.63	46.00	61.92	155.13	77.57
2	J. Lindner.....	1907	5.81	9.40	7.20	6.40	8.20	7.90	7.50	4.25	3.60	5.00	15.33	30.94	49.18	65.26	160.71	80.36
12	C. L. Linhardt...	1906	4.90	7.50	7.40	6.24	7.10	7.30	7.70	3.50	3.60	5.00	15.25	30.69	47.50	60.24	153.68	76.84
1	C. L. Maas.....	1906	6.58	9.20	8.20	6.48	7.80	8.10	8.60	4.55	4.25	5.00	15.53	31.28	47.36	68.76	162.93	81.47
9	S. P. Stewart, Jr.	1905	5.04	7.90	7.09	6.64	7.00	7.80	8.00	3.60	3.90	3.00	14.69	31.99	45.58	59.88	152.14	76.07
11	J. W. H. Stoudenmire..	1906	4.90	9.20	8.10	5.92	7.30	8.10	8.00	4.00	4.20	2.00	16.48	26.98	44.46	57.72	145.64	72.82
3	E. L. Wolfe.....	1906	4.90	8.70	7.60	6.56	7.40	7.60	7.80	3.65	3.95	4.15	15.54	30.67	47.98	62.31	156.50	78.25

## BALTIMORE POLYTECHNIC INSTITUTE.

## FOURTH YEAR RECORD AND FINAL MERIT ROLL OF GRADUATING CLASS OF 1911.

Order of Merit.	NAMES.	Date of Admission.	Mechanics.	Mechanics of Materials.	Steam Engineering.	Mech. Drawing and Design.	Diff. and Integral Calculus.	Chemistry.	Applied Electricity.	French.	Practice.	Department.	Aggregate				Aggregate for Four Years.	Graduating Average.
													for 1st Year.	for 2nd Year.	for 3rd Year.	for 4th Year.		
	MAXIMA.		7	10	10	8	10	10	10	5	5	5	20	40	60	80	200	100
65	J. B. Adt.....	1907	5.04	7.00	7.00	6.32	7.20	7.00	7.80	3.75	3.50	3.30	14.36	30.80	47.84	57.91	150.91	75.46
32	W. E. Bader.....	1907	4.97	7.00	7.00	6.56	7.70	7.40	8.50	3.75	4.05	4.90	16.84	34.28	50.28	61.83	163.23	81.62
22	W. T. Ballard....	1907	5.81	8.60	8.50	7.12	8.40	7.60	8.80	4.25	4.25	4.40	17.59	35.58	49.02	67.73	169.92	84.96
71	G. J. Barry.....	1907	4.90	7.00	7.00	5.76	7.10	7.20	7.10	3.55	3.60	4.05	12.52	32.84	46.50	57.26	149.12	74.56
61	C. P. Bartgis.....	1907	4.90	7.00	7.00	6.80	7.00	7.30	7.40	3.70	4.15	5.00	15.34	30.00	46.52	60.35	152.21	76.11
66	J. G. Bauernschmidt...	1906	4.90	7.00	7.00	6.08	7.40	7.00	7.40	3.70	3.50	3.55	15.08	31.37	46.92	57.53	150.90	75.45
54	C. T. Bevan.....	1906	5.11	7.00	7.20	6.72	7.40	7.00	7.60	4.20	3.80	4.70	15.43	30.49	47.70	60.73	154.35	77.18
38	G. W. Black.....	1907	4.97	8.10	8.50	6.64	8.10	7.50	8.00	3.90	3.95	3.65	16.50	33.32	48.74	63.31	161.87	80.94
27	J. Bohnlofink.....	1907	5.46	7.20	7.50	6.80	8.30	7.50	8.30	3.95	4.10	4.85	16.84	34.64	51.56	63.96	167.00	83.50
47	A. F. Bristor.....	1907	4.90	7.00	7.30	6.64	7.80	7.10	8.40	3.70	3.75	5.00	15.48	30.86	48.70	61.59	156.63	78.32
33	L. M. Brooks....	1907	5.46	7.40	7.10	6.32	7.90	7.60	7.50	4.05	3.95	5.00	16.16	37.00	47.60	62.28	163.04	81.52

## BALTIMORE POLYTECHNIC INSTITUTE.

FOURTH YEAR RECORD AND FINAL MERIT ROLL OF GRADUATING CLASS OF 1911—Continued.

Order of Merit.	NAMES.	Date of Admission.	Mechanics.	Mechanics of Materials.	Steam Engineering.	Mech. Drawing and Design.	Diff. and Integral Calculus.	Chemistry.	Applied Electricity.	French.	Practice.	Department.	Aggregate				Graduating Average.	
													for 1st Year.	for 2nd Year.	for 3rd Year.	for 4th Year.		
	MAXIMA.		7	10	10	8	10	10	10	5	5	5	20	40	60	80	200	100
*3	W. C. Brooke,....	1907	6.30	9.00	9.40	7.04	9.20	8.30	9.20	3.65	4.50	4.75	16.98	37.00	54.34	71.34	179.66	89.83
57	W. T. Brooks,....	1907	5.81	8.40	8.50	6.72	7.80	7.60	8.30	3.80	3.90	4.15	14.67	29.32	45.10	64.78	153.87	76.94
70	W. A. Brown,....	1906	4.90	7.00	7.00	6.48	7.10	7.40	7.30	3.50	3.65	4.30	15.93	31.14	43.50	58.63	149.20	74.60
*4	C. S. Burlingham, Jr. ...	1907	6.09	8.50	8.00	7.20	9.10	8.00	8.80	4.60	4.30	4.75	17.68	37.11	55.28	69.34	179.41	89.71
58	J. F. Coursey,....	1907	5.60	8.40	8.20	6.00	7.40	7.40	8.70	4.25	4.10	3.15	16.15	30.51	44.00	63.20	153.86	76.93
36	C. R. Cox,.....	1907	6.44	8.60	8.80	6.40	7.10	7.40	8.90	3.50	3.95	5.00	15.27	33.48	47.46	66.09	162.30	81.15
*10	E. H. Dix, Jr. ....	1907	5.95	8.60	8.20	6.88	8.30	8.00	8.70	3.90	4.40	5.00	17.65	35.95	54.10	67.93	175.63	87.82
28	G. M. Edwards,...	1907	5.60	8.60	9.00	6.88	8.40	8.10	8.70	3.50	4.40	4.90	15.99	31.91	50.78	68.08	166.76	83.38
*7	H. H. Elliott,....	1907	6.37	8.80	8.90	6.96	9.10	7.70	8.70	3.85	4.45	5.00	17.51	36.65	53.20	69.83	177.19	88.60
†74	J. G. Forster, Jr. .	1907	4.90	7.00	7.00	5.68	7.10	7.30	7.10	3.90	3.60	5.00	14.78	30.63	45.88	58.58	149.87	74.94
72	D. Frames,.....	1907	4.90	7.00	7.00	5.68	7.30	7.30	7.20	3.75	3.65	3.95	14.76	30.16	45.18	57.73	147.83	73.92

## BALTIMORE POLYTECHNIC INSTITUTE.

## FOURTH YEAR RECORD AND FINAL MERIT ROLL OF GRADUATING CLASS OF 1911—Continued.

Order of Merit.	NAMES.	Date of Admission.	Mechanics.	Mechanics of Materials.	Steam Engineering.	Mech. Drawing and Design.	Diff. and Integral Calculus.	Chemistry.	Applied Electricity.	French.	Practice.	Department.	Aggregate for 1st Year.	Aggregate for 2nd Year.	Aggregate for 3rd Year.	Aggregate for 4th Year.	Aggregate for Four Years.	Graduating Average.
	MAXIMA.		7	10	10	8	10	10	10	5	5	5	20	40	60	80	200	100
*18	B. Goodman.....	1907	5.32	8.50	8.60	6.96	8.50	8.20	8.20	3.65	4.15	5.00	16.34	34.78	52.74	67.08	170.94	85.47
31	L. S. Green.....	1907	4.90	7.90	7.50	6.64	8.40	8.50	8.30	3.50	4.10	5.00	16.46	32.55	50.80	63.74	163.55	81.78
*8	S. T. W. Green..	1907	5.95	8.90	8.60	7.04	9.30	8.00	8.70	4.50	3.95	4.00	18.05	36.34	53.52	68.94	176.85	88.43
68	J. F. Gross.....	1907	4.90	7.00	7.60	6.08	7.50	7.00	7.80	3.50	3.55	0.90	15.58	31.68	47.42	55.83	150.51	75.26
*12	S. Halle.....	1907	5.74	8.20	8.60	6.80	8.40	8.10	8.40	4.40	4.10	5.00	16.82	35.17	53.48	67.74	173.21	86.61
25	A. F. Holston....	1906	4.97	7.90	7.30	6.64	8.70	7.80	8.20	3.80	4.10	5.00	17.66	35.19	51.44	64.40	168.69	84.35
41	H. B. How.....	1907	5.04	7.00	7.00	6.72	8.20	7.00	7.80	3.80	3.75	3.50	16.15	33.68	50.50	59.81	160.14	80.07
35	R. E. Kaestner...	1907	5.11	8.50	8.10	6.96	8.30	7.10	8.00	4.50	3.70	4.50	15.48	32.50	49.94	64.77	162.69	81.35
29	J. Kavanaugh....	1906	6.09	9.30	9.00	6.64	7.80	7.60	8.10	4.25	3.95	4.15	15.13	33.29	49.26	66.88	164.56	82.28
40	C. W. Keefer....	1907	4.90	7.40	7.00	6.80	7.80	7.20	8.00	3.50	4.05	5.00	16.51	34.20	48.78	61.65	161.14	80.57
*21	F. M. Kipp, Jr....	1907	5.39	8.40	8.10	6.72	8.90	8.00	8.90	4.10	4.05	5.00	16.58	34.05	52.04	67.56	170.23	85.12

## BALTIMORE POLYTECHNIC INSTITUTE.

## FOURTH YEAR RECORD AND FINAL MERIT ROLL OF GRADUATING CLASS OF 1911—Continued.

Order of Merit.	NAMES.	Date of Admission.	Mechanics.		Mechanics of Materials.		Steam Engineering.		Mech. Drawing and Design.		Diff. and Integral Calculus.		Chemistry.		Applied Electricity.		French.		Practice.		Department.		Aggregate for 1st Year.		Aggregate for 2nd Year.		Aggregate for 3rd Year.		Aggregate for 4th Year.		Aggregate for Four Years.		Graduating Average.
			7	10	10	10	10	8	10	10	10	10	10	10	5	5	5	5	20	40	60	80	200	100									
46	MAXIMA.																																
	S. J. Krotee.....	1907	4.97	7.00	7.00	7.40	6.48	7.50	7.40	7.00	7.40	6.48	7.00	7.40	8.20	3.65	3.50	3.65	32.75	47.50	60.70	156.98	78.49										
48	O. Laws.....	1907	5.60	8.20	8.10	7.60	6.80	8.10	7.60	7.10	7.60	6.80	7.10	7.50	7.50	4.15	3.50	4.15	31.42	46.48	62.80	156.56	78.28										
49	A. B. Leonard....	1907	4.90	7.50	7.50	7.80	6.80	7.50	7.80	7.40	7.80	6.80	7.40	7.90	7.90	3.70	3.75	3.70	30.49	48.14	62.25	156.25	78.13										
56	S. Leskawa.....	1907	5.32	7.00	7.00	7.30	6.40	7.00	7.30	7.00	7.30	6.40	7.00	7.10	7.10	3.90	3.50	3.90	31.82	46.88	59.32	153.96	76.98										
39	G. R. Loftus .....	1906	5.04	8.70	7.90	7.80	6.32	7.90	7.80	7.20	7.80	6.32	7.20	7.00	7.00	4.00	3.95	4.00	33.00	49.10	62.97	161.43	80.72										
*15	C. E. Loos .....	1907	5.11	8.60	8.30	8.80	7.04	8.30	8.80	8.40	8.80	7.04	8.40	8.60	8.60	4.55	3.95	4.55	34.95	52.26	68.35	171.99	86.00										
30	J. H. McKay .....	1907	6.02	8.40	8.10	8.10	6.64	8.10	8.10	8.00	8.10	6.64	8.00	7.80	7.80	4.10	3.85	4.10	32.37	50.04	66.01	164.33	82.17										
*19	E. R. McLaughlin	1907	5.25	8.20	8.10	8.50	6.64	8.10	8.50	8.20	8.50	6.64	8.20	9.20	9.20	4.35	4.00	4.35	34.88	52.00	67.24	170.85	85.43										
64	W. Mason.....	1907	5.25	7.40	7.50	7.30	6.24	7.50	7.30	7.00	7.30	6.24	7.00	7.90	7.90	3.65	4.05	3.65	31.33	45.16	59.99	151.68	75.84										
*14	H. S. Mazer.....	1907	6.16	8.70	8.80	9.60	6.64	8.80	9.60	8.90	9.60	6.64	8.90	9.00	9.00	4.30	4.45	4.30	34.16	51.64	70.70	172.49	86.25										
52	H. W. Meiml.....	1907	4.90	8.60	7.60	7.80	6.80	7.60	7.80	7.10	7.80	6.80	7.10	7.00	7.00	3.90	3.75	3.90	31.98	46.56	61.35	155.39	77.70										

## BALTIMORE POLYTECHNIC INSTITUTE.

## FOURTH YEAR RECORD AND FINAL MERIT ROLL OF GRADUATING CLASS OF 1911—Continued.

Order of Merit.	NAMES.	Date of Admission.	Mechanics.		Mechanics of Materials.		Steam Engineering.		Mech. Drawing and Design.		Diff. and Integral Calculus.		Chemistry.		Applied Electricity.		French.		Practice.		Department.		Aggregate for 1st Year.		Aggregate for 2nd Year.		Aggregate for 3rd Year.		Aggregate for 4th Year.		Aggregate for Four Years.		Graduating Average.	
			7	10	10	10	10	10	10	10	10	10	10	10	10	5	5	5	5	5	5	20	40	60	80	200	100							
* 11	MAXIMA. T. H. Morrison...	1907	5.88	8.20	8.90	8.30	8.60	4.35	4.15	5.00	17.50	35.89	51.96	69.32	174.67	87.34																		
60	F. A. Nickols. ...	1906	5.11	7.00	7.80	7.50	7.20	3.95	3.75	2.75	14.58	31.25	48.34	58.22	152.39	76.20																		
51	W. B. O'Connor...	1906	4.97	7.00	7.70	7.20	7.50	3.55	3.90	3.95	15.67	32.92	47.42	59.53	155.54	77.77																		
* 20	G. C. Pfaff .....	1907	6.02	8.40	9.00	8.10	8.70	3.80	4.20	5.00	17.16	34.44	50.82	68.02	170.44	85.22																		
50	W. E. Pinschmidt	1907	4.90	7.70	7.30	7.00	7.30	4.15	3.85	4.85	15.22	32.20	47.50	60.69	155.61	77.81																		
34	M. A. Polster.....	1907	6.37	9.00	7.80	7.30	8.20	3.55	4.40	4.10	15.18	32.83	48.66	66.24	162.91	81.46																		
26	C. W. Price .....	1907	5.81	7.90	8.30	8.20	9.20	3.50	4.35	4.55	16.50	34.38	50.76	66.61	168.25	84.13																		
59	H. M. Raushenbach ...	1907	4.97	7.00	7.20	7.40	7.20	3.55	4.45	4.60	15.42	31.63	45.84	60.37	153.26	76.63																		
62	W. G. Richardson, Jr. ...	1907	4.90	7.00	7.10	7.30	7.00	3.60	4.05	5.00	15.17	30.80	46.64	59.43	152.04	76.02																		
* 13	E. F. Ritterhoff ..	1907	5.95	7.80	8.60	8.00	9.00	3.50	4.35	5.00	17.33	34.56	52.50	68.36	172.75	86.38																		
* 6	G. Robinson .....	1907	5.25	8.30	8.90	8.70	9.70	4.30	4.60	5.00	17.27	35.63	54.48	70.73	178.11	89.06																		

## BALTIMORE POLYTECHNIC INSTITUTE.

## FOURTH YEAR RECORD AND FINAL MERIT ROLL OF GRADUATING CLASS OF 1911—Continued.

Order of Merit.	NAMES.	Date of Admission.	Mechanics.	Mechanics of Materials.	Steam Engineering.	Mech. Drawing and Design.	Diff. and Integral Calculus.	Chemistry.	Applied Electricity.	French.	Practice.	Department.	Aggregate.					Graduating Average.
													for 1st Year.	for 2nd Year.	for 3rd Year.	for 4th Year.	for Four Years.	
<b>69</b>	MAXIMA.		<b>7</b>	<b>10</b>	<b>10</b>	<b>8</b>	<b>10</b>	<b>10</b>	<b>10</b>	<b>5</b>	<b>5</b>	<b>5</b>	<b>20</b>	<b>40</b>	<b>60</b>	<b>80</b>	<b>200</b>	<b>100</b>
	J. J. Rodemeyer..	1905	4.90	7.00	7.50	5.76	7.00	7.20	7.60	3.90	3.50	5.00	15.30	30.71	44.77	59.36	150.14	75.07
<b>37</b>	E. C. Schaun.....	1907	4.90	8.30	7.60	6.48	8.10	7.70	7.70	3.50	4.20	5.00	16.24	34.07	48.42	63.48	162.21	81.11
<b>44</b>	J. F. Sendelbach..	1907	4.90	7.00	7.00	6.40	7.90	7.00	7.50	3.75	4.10	5.00	16.19	32.95	48.14	60.55	157.83	78.92
<b>*5</b>	A. L. Shalowitz ..	1907	6.16	8.80	8.70	7.28	8.80	8.80	8.60	4.40	4.25	4.45	17.53	36.15	54.58	70.24	178.50	89.25
<b>23</b>	J. Shoolbred, Jr....	1907	6.02	8.50	8.00	6.80	8.40	8.10	9.00	3.50	4.50	5.00	16.36	34.21	51.16	67.82	169.55	84.78
<b>24</b>	W. C. Short.....	1907	5.60	8.90	9.00	7.12	8.20	7.90	8.80	3.50	4.35	4.20	15.91	33.83	51.64	67.57	168.95	84.48
<b>42</b>	A. B. Smith.....	1907	4.90	7.70	7.80	6.56	7.00	7.00	7.30	3.50	4.30	4.75	16.78	33.60	47.74	60.81	158.93	79.47
<b>63</b>	G. N. Sohl.....	1907	4.90	7.00	7.00	5.68	7.00	7.00	7.20	3.50	3.80	5.00	16.29	32.23	45.10	58.08	151.70	75.85
<b>67</b>	H. Spafford.....	1907	4.90	7.00	7.00	6.64	7.00	7.00	7.00	3.70	4.00	4.70	14.53	30.35	46.92	58.94	150.74	75.37
<b>55</b>	C. E. Spott.....	1907	5.60	7.20	7.20	6.80	7.00	7.20	7.40	3.95	4.05	4.90	15.17	31.26	46.56	61.30	154.29	77.15
<b>53</b>	W. G. Steinmetz..	1907	5.11	7.40	7.00	6.44	7.90	7.00	7.00	3.55	4.00	4.75	15.65	31.49	47.70	60.35	155.19	77.60

# BALTIMORE POLYTECHNIC INSTITUTE.

## FOURTH YEAR RECORD AND FINAL MERIT ROLL OF GRADUATING CLASS OF 1911—Concluded.

Order of Merit.	NAMES.	Date of Admission.	Mechanics.	Mechanics of Materials.	Steam Engineering.	Mech. Drawing and Design.	Diff. and Integral Calculus.	Chemistry.	Applied Electricity.	French.	Practice.	Department.	Aggregate for 1st Year.	Aggregate for 2nd Year.	Aggregate for 3rd Year.	Aggregate for 4th Year.	Aggregate for Four Years.	Graduating Average.
			7	10	10	8	10	10	10	5	5	5	20	40	60	80	200	100
*2	W. W. Troxell.....	1907	6.51	9.20	9.30	6.88	9.50	8.80	9.30	4.75	4.30	4.55	17.67	37.07	55.70	73.09	183.53	91.77
*1	W. E. Vail.....	1907	6.09	8.70	9.00	7.12	9.40	8.40	9.00	4.35	4.65	5.00	18.73	38.09	56.42	71.71	184.95	92.48
43	O. G. Wilbur.....	1907	6.02	8.30	7.80	7.04	7.70	7.00	7.40	3.55	4.25	4.90	15.11	30.49	48.76	63.96	158.32	79.16
*16	L. E. Wilson.....	1907	6.02	8.10	7.80	6.88	8.70	8.00	8.50	3.50	4.20	5.00	16.69	35.60	52.90	66.70	171.89	85.95
45	L. V. Winchester.	1907	6.37	8.20	7.80	6.40	8.50	7.00	8.00	4.25	4.10	4.25	14.92	30.48	46.84	64.87	157.11	78.55
*17	H. M. Wood.....	1907	5.95	8.30	8.40	6.80	8.30	7.80	8.80	3.80	4.65	5.00	16.56	34.42	52.54	67.80	171.32	85.66
+73	C. Zieget, Jr.....	1907	4.90	7.00	7.00	6.32	7.00	7.30	7.00	3.55	3.70	5.00	15.89	32.83	46.10	58.77	153.59	76.80
*9	J. O. Ziefzfeld ...	1906	5.67	8.00	8.60	6.96	8.90	7.90	8.60	4.35	4.30	5.00	17.40	36.63	53.58	68.28	175.89	87.95

\* Received 85% or more of the aggregate multiple for the entire course.

+ Deficient in Mechanics of Materials; deficiency made up in September and diploma awarded.

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## ADDRESS TO GRADUATES

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## ADDRESS.

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*To the Graduating Class of 1911 of the Baltimore Polytechnic Institute  
by MR. CHARLES E. PHELPS, Chief Engineer of the  
Public Service Commission.*

LADIES AND GENTLEMEN:

Twenty-two years ago, the graduating class of which I was a member stood before an assemblage such as this, and upon a similar occasion received a parting admonition from the kindly gentlemen present, with large words of wisdom and copious measures of advice as to what our future relations to the world at large were to be, and what our attitude to persons and things generally should be; but it was never in my thoughts that at some future day the opportunity would arrive when I could strike back and hurl at you all these tremendous but pure thoughts which, once heard, are immediately rejected as archaic, unpractical and entirely impossible of realization by no one more so than the graduate just about to receive his sheep-skin.

Having thus had some preliminary training in the active workings of the mind of the average graduate who is looking to the future with hope, and an optimistic prevision of things to come, there does not occur to me anything I may say in the particular direction of offering advice that has not been already, or should have been, drilled into your daily school life by the instructors with whom you have been associated.

One of the fundamental elements in the proper training of the man who has later to take his place in this life of ours lies in his daily association with the character of men and women who form the corps of teachers and instructors in our public school system. The formation of correct early habits and the inculcation of high ideals, which so rarely fail to make their impress upon our after lives, are those which are the result of daily contact between instructor and pupil.

So it would be wasting valuable time and much energy for me to take advantage of the opportunity thus offered merely to gratify a natural human instinct to "come back" at you with advice that I may consider would fit your collective case.

It has been one of the valuable functions of the Baltimore Polytechnic Institute to teach men to be practical, in addition to giving them a high order of selective technical training, and it is in this vein that I desire to address myself to you.

The B. P. I. is an evolution. It is the successor of the successful effort made in 1884 to found, as a part of the public school system of Baltimore, a school where the boy and the young man might have an opportunity to equip himself with a training and a foundation to give him a fighting chance in the rapidly growing prominence of the technical crafts and professions.

Its predecessor school was known as the Baltimore Manual Training School, and it is due to absolute frankness to say that there is but little resemblance between the B. M. T. S. of 1889, as we then knew it, and the B. P. I. as we know it today.

The B. M. T. S. did not have, at least in its earliest days, an unimpeached reputation as a high-class school. Its purposes and aims were not well known and often entirely misunderstood. In fact, it was often ironically designated the Manual Labor School, and some even went so far as to look upon it as a reformatory institution for incorrigible boys. Even the youngsters of the Baltimore City College looked down upon us as comprising a lot who were sent to the B. M. T. S. because we were not fit to associate with them.

There was even at that day much serious and future productive work done at the school, and in largest measure this was due to the good fortune of our having at its head a product of Uncle Sam's Navy, the same type that has brought this B. P. I. to such a standing among the secondary technical schools of this country that you now look up to none.

Even at the risk of appearing to take advantage of your helplessness to register any protest, I feel that upon your leaving your alma mater for good and all I may be permitted another retrospective glance at the foundation of the B. P. I. and trace its growing influence and importance with that of the engineering profession generally, in the earnest hope that you may or do realize the advantages that you have enjoyed and the opportunities that the school itself has opened up to you.

Up to the formation of the B. P. I. there was practically no fundamental technical training in the school systems of this country. Therefore, there were training schools, but they were trade schools pure and simple. They instructed in certain crafts, but there they stopped. A little composition, a little algebra, practically no science, and a smattering of planing boards and forging cold chisels, etc.

Up to this time the engineer meant a civil engineer—railroad, hydraulic, mining, sanitary and allied crafts were entirely encompassed in the domain of the civil engineer. The mechanical engineer was known, but his activities were exceedingly limited; the electrical engineer, as an engineer, was unknown to the world—he was recognized only in the laboratory.

Thus at the date of founding the B. M. T. S. (1884) the field of opportunity seemed restricted in the purview of the graduate; thus it seemed as though there were no development possibilities unless it was in the building of railroads or enlargement of existing works; and it was just at this time that the engineer's domain began to expand in the development of new methods of communication and production of power that have since reached an importance that could not possibly have been realized at that time.

Like the first introduction of illuminating gas in the United States, and the first telegraph, this city of Baltimore enjoyed the distinction of having witnessed the initiation of the electric arc lamp and the first electric railway on a commercial scale; both these latter, the arc lamp and the electric railway, were contemporaneous with the advent of the B. P. I.

Such things as these may only be explained on the theory that the influence that regulates and guides the human mind and hand is greater than the human himself. It is a fact, however, that the development of nature's resources has caused an advancement in engineering possibilities and demands upon technical talent that have been and still are startling in the rapidity with which the human mind has adapted itself to them.

The genesis of technical training, as has been stated, was in the trade schools; now there is no such thing as a simon-pure trade school. It has frequently been stated that in an engineering sense this is the age of specialization. It is not. The day of the trade school or manual training school was the real tendency to specialization, and while today there are specialists among engineers, the true engineer is a man with a breadth of vision and flexibility of mind to apply nature's laws to a situation as he finds it. To do this the fundamental requirement is thorough technical training, to follow the laws of nature through their sequences, and with the training to make proper application of them as the occasion demands and the necessities require.

I can see no other requisite more truly indicative of the real engineer; but it is not meant to imply that an engineer should not specialize at all, but that, though it may be required that he does so, even then he must have a broadmindedness that will recognize the real thing when it passes him; and it may only pass once.

Those wonderful developments of engineering science which inaugurated a new era, beginning with the last decade of the nineteenth century (related to the advent of the electric arc lamp and the electric railway before referred to) were of necessity products of the work of specialists, as they were then viewed. But these same men afterwards proved to be the most catholic of engineers; their later works resulted in advancement, not only in electrical science, but in all the correlated avenues of industry. The alliance now existing between almost every phase of technical and scientific exploitation brings all classes of engineering work elbow to elbow. More frequently there is an overlapping of design and construction that makes it difficult to isolate any particular class of engineer.

To have reached a high present state of efficiency a technical school must of necessity have kept step with the progress in the arts and sciences; it must always continue to do so. Its scope should not, however, be limited to a mere rudimentary training, but should be of a comprehensive and exhaustive character. It is necessary first to combine an early training of the hand with an equal development of the mind, as is the purpose of the polytechnic school, and as in all things worth doing at all. If we set out to give the youth of our period a training which will fit him to take his place with all comers, it is worth our while to do it well and thoroughly. Remember, that at this point we are not contemplating such a thing as compulsory technical education; we are not to force any boy to adopt a trade or a profession to which he does not lend himself with fidelity and energy. But we are finding ourselves in competition with educational systems of other communities training men for the professions just as much so as we are in the strife of industrial competition, and it is for the earnest and competent youth who is seeking to expand and develop his natural mental endowments that I plead for the fullest possible public consideration in the future treatment of this school.

In our thoughts upon this subject we eliminate any reference to those youths who, by inheritance or otherwise, possess ample means to indulge to the full any tastes they may have for a luxurious and comfortable college existence. It is for the majority, those who by sheer force of character and capacity mean to succeed if success is possible, and who may elect to enter the field of engineering activity that finds its true place in the scheme of a technological institute in the public school system, as distinguished from a college or university conducted as a quasi-public institution.

The principle of the "survival of the fittest" attains its fullest significance in our public school system, and it is one of the greatest glories of our American citizenship that this principle gives us our best citizens. Is there fair reason why any graduate of a technical school,

having the ability and showing his aptitude for his chosen sphere in life, should not receive the fullest encouragement that the resources of his city and State can give him?

We are sending our young men out into the world in close competition with other young men, and their mental equipment, the thoroughness of their training and their stamina will be the "open sesame" that will determine their future success or their failure to "make good." We must not permit any of them to enter the race handicapped through lack of providing the proper facilities. There are many men today occupying inferior positions, but positions in which they nevertheless render valuable service to their employers, who are incapable of advancement because of lack of mental development and the absence of early opportunity to receive the necessary training.

I do not speak thus in relation to the graduates of the Polytechnic Institute from a merely theoretical acquaintance with what the products of such a school should be, but, on the contrary, with a direct knowledge of and experience with a not inconsiderable number of graduates and underclassmen whom I have had associated with me from time to time in various capacities on engineering work. This fact was the principal reason that prompted me to appear here this evening, and it seemed to me that it is only due the splendid work being done by this school, in spite of its narrow facilities, that it should be testified to by one who knows from actual practical experience.

There is, however, other and better evidence as to the standing of this Institute among the colleges of the country giving a finished technical education. A graduate of this school is permitted to enter these colleges in the second year of the engineering course, and this too without the necessity of undergoing an entrance examination. To those familiar with college routine this will at once convey an idea of considerable importance. The usual college course is four years, and before enrollment as a full-fledged student the applicant must undergo and pass an examination to demonstrate his capacity to take the first year's studies. Should the applicant not be completely successful in the entrance examination, but has exhibited an ability to make up his delinquencies, he is permitted to enter the first-year class with conditions; that is to say, he must, before the first term is over, pass an examination in those subjects which he failed upon at entrance. It is, therefore, evident in what regard the work of the Polytechnic Institute is held by those administering the affairs of these colleges, in that, not only do they accept the diploma of the Institute in lieu of the entrance examination, but they also regard it as a sufficient offset to the work required in the first year at college. Could a more fitting tribute to the fundamental worth of this school be desired than this?

However much gratification we may derive from this testimony it is, nevertheless, a fact that none of these colleges is situated in our own city or State. It is now fifteen years since any finished technical education could be had in the State of Maryland which is open to the graduates of this school.

It is one of my dreams to see established in this city an institute of technology conducted jointly under the auspices of the State of Maryland and the City of Baltimore. This cannot possibly raise any question of "building a Chinese wall" around ourselves, because such an institution, while conducted as a part of the public educational system, could, without prejudice, be open to any duly qualified applicant regardless of place of residence. There would be nothing in the slightest degree radical in its inauguration; the foundation is now well laid in the school which is deserving our attention tonight.

## SOME RECENT EXAMINATION PAPERS.

### MECHANICS OF MATERIALS.

FOURTH YEAR CLASS — May 18, 1910.

1. A 15-inch Cambria I-beam weighing 50 lbs. per foot, is loaded as shown in Fig. 1. Draw the shear diagram. Linear scale,  $\frac{1}{8}$  inch = 1 foot and load scale,  $\frac{1}{50}$  inch = 100 lbs. What is the maximum value of the shear and where does it occur? Where is the dangerous section and what is the value of the bending moment at that section? Is the beam safe? Why?

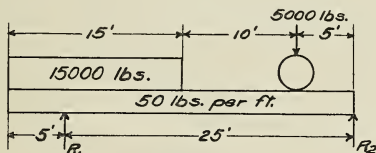


Fig. 1

2. Find the moment of inertia and radius of gyration of a trapezoid about the smaller base.

3. A wooden cantilever, 6 feet long, is required to support a load of 1,000 lbs. at a point 5 feet from the wall. Find the width if the depth is to be 12 inches and the maximum fibre stress is not to exceed 1,000 lbs. per square inch.

4. What safe load may be carried by a 24-inch Cambria I-beam weighing 100 lbs. per foot and 20 feet long when used in a building as a column with square ends?

5. Determine the diameter of a round steel bar subjected to a twisting moment of 1,000,000 lbs. ins. The maximum fibre stress should not exceed 10,000 lbs. per square inch.

6. Find the value of the deflection  $y$  at a point distant  $x$  from the wall of a cantilever loaded with  $W$  lbs. uniformly distributed (see Fig. 2) then show that its resilience is equal to

$$\frac{S^2}{2E} \cdot \frac{1}{5} \cdot \frac{k^2}{c^2} \cdot AL$$

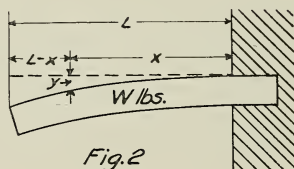


Fig. 2

Continued May 20, 1910.

(GRAPHIC STATICS.)

7. A beam is loaded as shown in Fig. 3. Disregarding the weight of the beam, construct the bending moment and shear diagrams for the loads shown. Find by measurement the maximum values of the bending moment and the shear and the point at which each occurs. Also find the point of inflection. Linear scale,  $\frac{1}{8}$  inch = 1 foot; load scale,  $\frac{1}{50}$  inch = 100 lbs.; polar distance, 1 inch. Determine bending moment scale. (Consider the distributed load by assuming it concentrated at 6 equidistant points.)

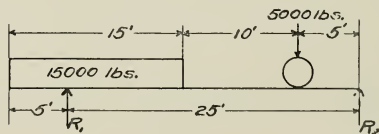


Fig. 3

8. A beam, 22 feet long, supports a load of 1,000 lbs. at a point 6 feet from the left end and one of 1,200 lbs. at 5 feet from the right end. In addition, there is a uniformly distributed load of 100 lbs. per foot. Construct the shear and bending moment diagrams. Scales: linear,  $\frac{3}{16}$  inch = 1 foot; load, 1 inch = 1,000 lbs.; bending moment, 1 inch = 8,000 lbs. ft.

9. The cantilever shown in Fig. 4 is loaded with 2,000 lbs. uniformly distributed along the top chord. Draw the reciprocal diagram to the

scale of 1 inch = 600 lbs. Tabulate the stresses and indicate their kind on the frame diagram. Find the total reactions at the wall. Linear scale,  $\frac{1}{4}$  inch = 1 foot.

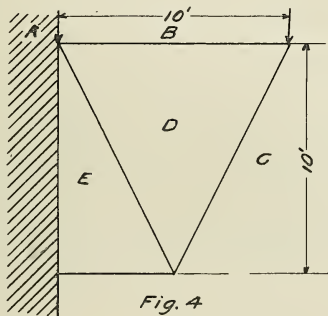


Fig. 4

10. For the crane shown in Fig. 5, calculate by the method of sections the magnitude and kind of stress in the members cut by the line  $xy$ .

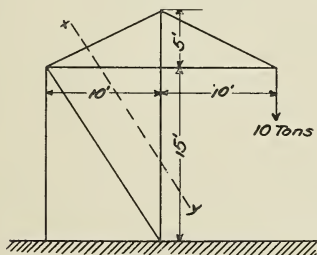


Fig. 5

11. The cambered roof truss shown in Fig. 6 is fixed at the left end and supported on rollers at the right end. The members BG, CH, DI, EK, EL, EM, are all equal. The distance between principals

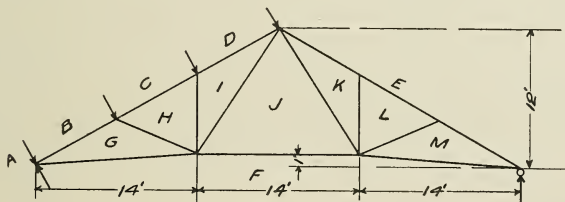


Fig. 6

is 15 feet. Draw the reciprocal diagram for the stresses produced by the wind blowing upon the left-hand rafter with an intensity such

as to produce a normal pressure of 25 lbs. per square foot of roof surface. Tabulate the value of the stresses and indicate their kind on the frame diagram. Scales: linear,  $\frac{1}{8}$  inch = 1 foot; load,  $\frac{1}{2}$  inch = 100 lbs.

### STEAM AND INTERNAL COMBUSTION ENGINES.

#### FOURTH YEAR CLASS — May, 1909.

(Questions 1 to 9 inclusive for First Section; Questions 3 to 11 inclusive for Second Section.)

1. Show with the aid of sketches the operation of the four-stroke cycle.
2. Sketch and describe the Keerting suction producer plant.
3. Draw indicator cards showing the effect of governing by: (a) Delayed ignition; (b) premature ignition; (c) throttling the normal charge; (d) cutting off.
4. What principles were laid down by the inventor in the design of the Diesel engine? Sketch and describe the device for supplying fuel to the cylinder.
5. The following data were taken from a test of natural gas made with a Junker calorimeter: Amount of water, 0.3689 cu. ft.; differences in meter readings, 1 cu. ft.; temperature of room,  $72.73^{\circ}$  F.; temperature of inlet water,  $53.42^{\circ}$ ; temperature of outlet water,  $94.3^{\circ}$ ; temperature of gas at meter,  $71.22^{\circ}$ ; temperature of gas in chimney,  $60.33^{\circ}$ ; pressure of gas, 0.2 inch of water; barometer reading, 14.49 lbs. per sq. inch. Find: (a) B. T. U. per cubic foot of gas at conditions of test; (b) B. T. U. per cubic foot of gas under standard conditions.
6. Sketch and describe a gasoline vaporizer.
7. Sketch and describe the Hornsby-Akroyd oil engine.
8. The following data were taken from a test of a Diesel engine using kerosene: Diameter of cylinder, 15.75 inches; stroke, 23.65 inches; r.p.m., 158.8; M. E. P. from diagram, 92.252 lbs. per sq. inch; B. T. U. per lb. of fuel, 18,610; fuel consumption per hour, 29.84 lbs.; length of Prony brake arm, 60 inches; pressure on scales, 460.4 lbs. Find: (a) I. H. P.; (b) B. H. P.; (c) mechanical efficiency; (d) thermal efficiency based on B. H. P.
9. Name four faults which produce in each case: Weak explosions; misfire; premature ignition. Name two faults which cause smoky exhaust.

10. A 16"x20" engine uses steam at 120.3 lbs. gauge pressure. Back pressure, 3 lbs. absolute; r.p.m., 165; cut-off, 0.25 stroke; clearance, 4%; dryness fraction of the steam, 0.98; thermal value of the fuel, 14,300 B. T. U.; temperature of the steam, 350°; temperature of feed water, 132°; boiler efficiency, 70%. The specific volume of the working steam is 3.329 cubic feet. Using a mean pressure factor of 0.9, find: (a) Pounds of steam per I. H. P. per hour; (b) pounds of water evaporated per pound of coal; (c) pounds of coal per I. H. P. per hour.

11. Show that the weight of the reciprocating parts of a simple duplex engine is greater than that of a compound engine of the same power, the two types having in common: Initial steam pressure, 115 lbs. absolute; exhaust pressure, 2 lbs. absolute; ratio of expansion, 8. For the compound engine the receiver pressure is 28 lbs. absolute, and the ratio of the cylinders is 4.

### MECHANICS.

#### FOURTH YEAR CLASS — January, 1910.

1. A body starts from rest and moves with a constant acceleration. If it passes over 35 ft. during the fourth second from rest, what is its acceleration?

2. Part of a machine is moving southeast at 10 feet per second and after one-half second it is moving east at 4 feet per second. What is the amount and direction of the average acceleration during the one-half second? If the mass of the part is one ton, what was the magnitude of the average force acting on it?

3. A 20-ton car accelerates from 10 to 20 miles an hour in 15 seconds down an incline of 1 in 100 against a uniform frictional resistance of 25 lbs. per ton. The motors exert a uniform tractive effort during the 15 seconds. Find: The accelerating force; the uniform pull of the motors; the horsepower developed by the motors at the beginning of the period; the space passed through.

4. With the same conditions as given in problem 3, find the increase in kinetic energy and the decrease in potential energy of the car, the work done in overcoming the frictional resistance, and the work done by the motors. Write the equation of energy containing these four quantities.

5. A 20-ton car is rounding a curve of 1,000 feet radius at 40 miles per hour. What is the magnitude and direction of its acceleration? How large a force is necessary to give the car this acceleration?

6. A 10-lb. weight is prevented from sliding down a rough inclined plane by a horizontal force of 5 pounds. If the inclination of the plane is  $30^\circ$ , what is the value of the coefficient of friction called into play?

7. A crane has a vertical post 9 feet high and a boom 18 feet long weighing 0.5 ton. The angle between the boom and post is  $45^\circ$  and a weight of 5 tons is suspended from the end of the boom. Find the tension of the tie joining the end of the boom and the top of the post, and the magnitude and direction of the thrust on the lower end of the boom.

8. Find by construction and by calculation the distance from the bottom edge to the centre of gravity of an unequally flanged beam section of the following dimensions: Top flange, 3 inches wide and 1.5 inches thick; bottom flange, 15 inches wide and 1.75 inches thick; web, 1.5 inches thick; total height, 18 inches.

9. Determine the width of single-ply leather belting required to transmit 40 H. P. from a pulley 4 feet in diameter making 375 r.p.m. Assume: Arc of contact,  $172.4^\circ$ ; coefficient of friction, 0.3; density of leather, 0.036 lbs. per cubic inch; thickness of belt,  $7/32$  inch; working stress, 66 pounds per inch width of belt. Take into consideration centrifugal force and the thickness of the belt.

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#### MECHANICAL LABORATORY PRACTICE.

#### FOURTH YEAR CLASS — May, 1909.

1. In what two ways does carbon combine with iron to form cast iron. How are cast irons graded? What is the effect of manganese on cast iron?

2. Describe the process of making crucible steel; bessemer steel; open hearth steel. What is semi-steel?

3. Name the type of governor on the high-speed engine in the laboratory and describe its action. How may the steam consumption of an engine be found other than by the indicator?

4. Explain fully with the aid of a sketch how to find the indicated steam consumption of a compound engine from the high pressure cylinder diagram.

5. Describe the throttling calorimeter and give the theory of its action. How would very wet steam be indicated? How would superheated steam be shown and how may the number of degrees of superheat be found?

## DIFFERENTIAL CALCULUS.

## FOURTH YEAR CLASS — JUNE, 1909.

1. Define increment and derivative. Illustrate by finding the derivative of the function  $y = \sqrt{a^2 - x^2}$ .

2. Find  $\frac{dy}{dx}$  when  $x = a \log \frac{y + \sqrt{y^2 + a}}{\sqrt{a}}$

3. What is the area of an equilateral triangle at the moment its side is increasing at the rate of 10 feet per minute and its area at the rate of 10 square feet per second?

4. Find  $\frac{dy}{dx}$  from  $y = (x^2 + 1) \sqrt{x^3 - x}$ .

5. Find  $\frac{dy}{d\theta}$  from  $y = \log \frac{\sin \frac{1}{2} (\theta - a)}{\sin \frac{1}{2} (\theta + a)}$

6. Find  $\frac{d^3y}{dx^3}$  from  $y = (\sin x - \cos x) x e^x + 3e^x \cos x$ .

7. Determine the limiting value of  $\frac{\log(x^2 - 4x + 5)}{\log \cos(x - 2)}$  when  $x = 2$ .

8. Find the tangent of  $44^\circ$ , using Taylor's Theorem.

9. A weight of 1,000 pounds hanging two feet from the fulcrum end of a lever is to be raised by an upward force at the other end. Supposing the lever to weigh 10 pounds per foot, find its length that the force may be a minimum.

10. Find the equations of the two tangents to the circle  $x^2 + y^2 - 3y = 14$ , parallel to the line  $7y = 4x + 6$ .

11. Change the independent variable from  $x$  to  $z$  in the following:

$$\frac{d^2y}{dx^2} + \frac{1}{x} \frac{dy}{dx} + y = 0, \text{ when } x^2 = 4z.$$

Omit any one except 4 or 9.

## INTEGRAL CALCULUS.

## FOURTH YEAR CLASS — MAY, 1909.

1. Find the equations of the asymptotes of the hyperbola  $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ .

2. If the co-ordinates of the centre of curvature of the equilateral hyperbola  $2xy = a^2$  have the relations  $A + B = \frac{(y+x)^3}{a^2}$  and  $A - B = \frac{(y-x)^3}{a^2}$ , prove that the equation of the evolute is  $(A+B)^{2/3} - (A-B)^{2/3} = 2a^{2/3}$ .

3.  $\int \frac{x+3}{\sqrt{x^2+4}} dx = ?$

4. The slope of the tangent to a curve at any point is  $-\frac{4x}{9y}$ , and the curve passes through the point (3, 2). Find the equation.

5.  $\int \frac{xdx}{(x+1)(x+3)(x+5)} = ?$

6.  $\int \frac{dx}{x + \sqrt{2x-1}} = ?$

7.  $\int \frac{\tan^7 x + 1}{\tan x + 1} dx = ?$

8.  $\int x^2 \tan^{-1} x dx = ?$

9. Find the entire area of the curve  $p^2 = a^2 \cos 2\theta$ . Plot the curve.

10. Find the volume generated by turning about the X-axis the portions of the curve  $x^2 - 3x + 2y = 0$  which is above the X-axis.

## TRIGONOMETRY.

## SECOND YEAR CLASS — June, 1909.

1. (a) On the circumference of a circle of 50 feet radius an arc of 10 feet is laid off. How many degrees in the angle at the centre subtended by this arc? (b) Given  $\cos 2A = \sin A$ , find the number of degrees in the angle A.
2. Find the value of the six functions of  $60^\circ$ .
3. Given  $\tan A = 3$ , find the other functions of the angle A.
4. Solve the equation  $\sin^2 x - \cos x = -\frac{1}{4}$ .
5. From a tower 58 feet high the angles of depression of two objects situated in the same horizontal line with the base of the tower, and on the same side, are  $30^\circ 13' 18''$  and  $45^\circ 46' 14''$ . Find the distance between these objects.

## ANALYTIC GEOMETRY.

## THIRD YEAR CLASS — June, 1909.

1. Find the equation of the ellipse, having given the foci and the constant sum 2a.
2. The equation of an ellipse is  $25x^2 + 81y^2 = 450x$  when referred to rectangular axes. Find the major and minor axes and the co-ordinates of the centre.
3. Tangents are drawn from (3, 2) to the ellipse  $x^2 + 4y^2 = 4$ . Find the equation of the chord of contact, and of the line that joins (3, 2) to the mid-point of the chord.
4. Find the equations of the tangent and the normal to the hyperbola at the point  $(x_1, y_1)$  on the curve.
5. Write the equation of the hyperbola conjugate to  $9x^2 - 16y^2 = 144$ , and find its axes, distance between its foci, and its latus rectum.
6. Find the length of the semi-diameter conjugate to the diameter  $y = 3x$  in the hyperbola  $9x^2 - 4y^2 = 36$ .
7. Define the Conchoid of Nicomedes. Develop its equation and discuss it.
8. Plot the curve whose equation is  $r = a(1 - \cos \theta)$ .

## SURVEYING.

## THIRD YEAR CLASS — June 12, 1908.

1. Show, by drawing, a vernier reading 7.563.
2. From the following field notes, plot the field and calculate its area:

1. N.  $73^{\circ} 30'$  W. 5.00 chains.
2. S.  $16^{\circ} 30'$  W. 5.00 chains.
3. N.  $28^{\circ} 30'$  W. 7.07 chains.
4. N.  $20^{\circ} 00'$  E. 11.18 chains.
5. S.  $43^{\circ} 30'$  E. 5.00 chains.
6. S.  $13^{\circ} 30'$  E. 10.00 chains.

3. In the triangle ABC,  $AB = 12$  chains,  $AC = 10$  chains, and  $BC = 8$  chains; part off a trapezoid of 1 acre 96 perches by the line DE parallel to AB.

4. Write the proper numbers in the third and fifth columns in this scheme, make a profile of the section, and determine the gradient per station:

Station	+ S	H. I.	-S	H. S.	Remarks
0	6.944		7.4		Bench on post 22 feet north of 0.
1			3.9		
2			5.6		
3			4.6		
t. p.	3.855		5.513		
4			4.9		
5			3.5		
6			1.2		

## ALGEBRA.

## SECOND YEAR CLASS — June, 1909.

1. In how many different ways can \$1.65 be paid in quarter dollars and dimes?

2. Expand  $\frac{1}{(a - 2b^2)}$  to four terms by the Binomial Theorem and simplify the result.

3. Write the sixth term of  $(27x^3 - 8y^3)^{\frac{1}{3}}$ .

4. Find  $l$  and  $n$  in the arithmetical progression in which  $a = 7$ ,  $d = 2$ , and  $S = 1927$ .

5. The sum of three terms in geometric progression is 63 and the third is 45 greater than the first. What are the terms?

6. Find by logarithms the value of  $\frac{4.5921 \sqrt[3]{0.021946}}{(0.41587)^3}$ .

7. Solve  $0.98765^x = 2.47$ .

8. Find the diameter of a spherical shell whose thickness is 2 inches, and whose weight is  $\frac{19}{27}$  of what it would be if it were solid.

## GEOMETRY.

## SECOND YEAR CLASS — June, 1909.

1. Prove that the volume of a triangular pyramid is equal to one-third of the product of its base by its altitude.

2. Prove that the volume of two triangular pyramids, having a trihedral angle of the one equal to a trihedral angle of the other, are to each other as the products of the three edges of these trihedral angles.

3. Prove that every section of a circular cone made by a plane parallel to the base is a circle.

4. Find the diameter of a given material sphere.

5. Find the radius of a circle determined by a plane one inch from the centre of a sphere 5 inches in diameter.

**ELECTRICITY.****FOURTH YEAR CLASS — January 27, 1911.**

1. A shunt motor, connected to 110-volt supply mains, takes 2.4 amperes through the field coils and 2.5 amperes through the armature when running with no load. The resistance of the armature is 0.15 ohm, including brushes and contacts. What will be the efficiency of the motor when the armature current is 40 amperes? What will be the horsepower required to drive this generator when supplying the above current?

2. What electromotive force will be produced by a 6-pole generator, lap wound, with 338 conductors on the armature, the speed of the armature being 900 revolutions per minute, and the flux per magnet pole 1,600,000 lines? If the armature resistance were 0.09 ohm, what electromotive force would be delivered at the brushes with an armature current of 60 amperes?

3. Make a diagram for two compound generators in parallel, showing the equalizer. Make a diagram of a starting box, with low-voltage release, for a shunt motor, showing line wires and motor armature and field.

4. Give the winding scheme for a 4-pole, simplex, lap-wound armature, the back pitch being 31. Illustrate the difference between a duplex winding and a doubly re-entrant winding by making diagrams of a duplex, singly re-entrant winding and a duplex, double re-entrant winding, carefully numbering the commutator segments.

5. A three-wire system, 600 feet in length, supplies 800 lamps (0.5 ampere per lamp), at 110 volts, the voltage at the generator being 223. Considering the system as balanced and the lamps as concentrated at the end of the line, calculate the sizes, B. & S. gauge, for the mains and the neutral wire, considering the neutral as one-half the sectional area of the outside main. What voltage would each group of lamps receive if 500 lamps were on one side and 300 lamps on the other? Calculate to tenths of a volt.

6. What is the explanation of the high efficiency of the tungsten lamp? Describe the essentials of the Nernst lamp. Discuss the carbon arc lamp.

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**ELECTRICITY.****FOURTH YEAR CLASS — May 31, 1911.**

1. Name the different systems used for the operation of electric railways. Make a diagram of the single-phase controller, showing the connections of the transformer. Show how the controller may be used on direct current.

2. A single-phase alternator has 32 poles and makes 94 revolutions per minute. The stationary armature is made up of 32 coils of 18 turns each, and the magnetic flux from each pole piece is 5,000,000 lines. What electromotive force will the machine supply?

3. A three-phase generator, whose capacity when star-connected is 85 amperes at 13,200 volts, is altered to a delta connection. What should be the new rating of the machine as to volts, amperes and kilowatts?

4. (a) How is the potential output of a rotary converter regulated? (b) What two methods are used for determining at the power station the voltages at the distribution centers? (c) State what voltages are used for high-tension transmission, placing those which are supplied from generators in one column and those which are stepped-up in another.

5. (a) What is meant by the term slip as applied to the induction motor? (b) briefly describe the action of a frequency changer. (c) Distinguish between the motor generator and the rotary converter.

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#### CHEMISTRY.

##### FOURTH YEAR CLASS — January 31, 1911.

1. Prepare a tabulated statement showing the occurrence in nature, method of preparation, principal compounds, and chemical and physical properties of the following: Sodium, potassium, calcium and magnesium.

2. How are gold and silver separated from their ores?

3. Give details for the preparation of the following: Ethyl alcohol, acetic acid, and sugar.

4. What precaution should be taken in an analysis for potassium? Why is it necessary to boil a substance with  $\text{Na}_2\text{CO}_3$  before testing for most of the acids?

5. In what order are solvents applied to a powder? What substance is insoluble in all acids? Give a method for preparing a solution of this substance.

6. Write a complete set of equations expressing the reactions for the analysis of any three of the following compounds:  $\text{NH}_4\text{Cl}$ ,  $\text{PbCO}_3$ ,  $\text{Ba}(\text{NO}_3)_2$ ,  $\text{FeS}$ ,  $\text{KBr}$ ,  $\text{MgSO}_4$ .

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#### CHEMISTRY.

##### FOURTH YEAR CLASS — May 29, 1911.

1. State how complete titration is recognized in the following determinations: Ammonia, iron, manganese, mercury, phosphorus, silver, sulphuric acid.

2. Tabulate the principal stages in making a determination of carbon in steel by the method of combustion, and name the reagents used for each absorption.

3. What per cent. of iron is indicated in an ore which, to oxidize the iron in 12.4 grams of a sample, requires 400 cc. of a standard solution of potassium permanganate containing 1.41 grams to the liter?

4. A sample of illuminating gas shows, on analysis, the following composition: Carbon dioxide, 3.6%; illuminants, 7.2%; oxygen, 0.8%; carbon monoxide, 19.8%. 13.4 cc. of the gas were admitted to the burette and mixed with air to make the volume 99.2 cc. After explosion the first contraction was 20.6 cc. and the second contraction, 6.6 cc. Complete the report of the analysis, giving a summary of the results.

5. A sample of natural gas contains: Marsh gas ( $\text{CH}_4$ ), 61%; hydrogen ( $\text{H}_2$ ), 29%; ethane ( $\text{C}_2\text{H}_6$ ), 8%; olefiant gas ( $\text{C}_2\text{H}_4$ ), 1%; oxygen ( $\text{O}_2$ ), 0.6%; carbon monoxide ( $\text{CO}$ ), 0.4%. Require the relative volume of air necessary to burn it and the products of combustion. Tabulate results.

6. A Bessemer converter contains 10 metric tons of pig iron of the following composition: Carbon, 3%; manganese, 0.5%; silicon, 1.5%; iron, 95%. On being blown, one-third of the carbon burns to  $\text{CO}_2$  and the rest to  $\text{CO}$ ; 5% of the iron is oxidized, and no free oxygen escapes from the converter. The blast is assumed to be dry. What weight of oxygen is needed during the blow? How many cubic meters of air at standard conditions will be needed? What will be the average composition of the gas produced?

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#### ENGLISH.

#### THIRD YEAR CLASS — June 10, 1909.

Write on five of these subjects, viz.: 2; 4; 7; 1 or 3; and 5 or 6.

1. Milton's Puritanism.
2. What "Comus" is.
3. Some characteristics of Milton's style.
4. The essentials of a good argument.
5. A summary of Burke's objections to Lord North's bill.
6. The Polytechnic should close at noon on Wednesdays and Saturdays, instead of all day on Saturdays.
7. The formation of the English Language.

**ENGLISH.****SECOND YEAR CLASS — June 8, 1909.**

1. Give, in the form of a connected theme, the following information about the "Spectator": (a) its origin; (b) its contributors; (c) its character; (d) its purpose.

2. Discuss the stories that make up "The Merchant of Venice," explaining how they are worked into each other to make one story.

3. Write on the following subjects:

(a) Shylock was more sinned against than sinning. (Take the affirmative or negative, construct a brief, and write the argument.)

(b) The place of Act V in "The Merchant of Venice."

(c) One of the following: (1) My visits to Buffalo Bill's show. (2) An exciting baseball game. (3) My plans for the summer. (4) Along the water front of Baltimore. (5) My holiday.

(d) One of the following: (1) Sir Roger's visit to the Polytechnic Institute; (2) Sir Roger's butler in Lexington Market; (3) the "Spectator" at Oriole Park.

4. Name the different types of discourse, state the purpose of each, and mention at least two of the most important rhetorical principles that apply to each.

**HISTORY AND CIVICS.****SECOND YEAR CLASS — June, 1909.**

*Answer any five questions.*

1. (a) Write a sketch of each of the following, mentioning public offices held, political principles, personal character, and influence on public affairs: (1) Henry Clay; (2) Abraham Lincoln; (3) Jefferson Davis.

(b) Define the following terms: Writ of habeas corpus, ex post facto law, paper blockade, original and appellate jurisdiction, copperhead.

2. (a) What is international law and how does it come to be recognized?

(b) Mention several cases in American history where disputes have arisen concerning international law.

- (c) How is a treaty made by the United States?
- (d) Mention four important treaties negotiated by the United States.
- 3. (a) Write a brief account of the Federal judiciary, telling of (1) its organization, (2) its independence, (3) the matters in which it has jurisdiction.  
(b) Name four important decisions of the Federal Supreme Court, and tell the influence of each.
- 4. (a) How may the Federal Constitution be amended?  
(b) Give an account of the amendments that have been made, stating their provisions and the circumstances connected with their adoption.
- 5. (a) Write a brief account of (1) the Whig Party, (2) the Democratic Party from 1828 to 1861, and (3) the Republican Party to 1861.  
(b) In what three ways, in the course of our history, have party candidates for the presidency been named?
- 6. (a) State fully the constitutional powers of Congress over foreign commerce.  
(b) Mention three examples of legislation in which these powers were exercised; stating in each case the time, provisions, and purpose of the act. (The acts chosen must represent three different kinds of legislation.)

**SPECIMEN ENTRANCE EXAMINATION PAPERS.**

**Set for Pupils Other Than Those Promoted From  
the Grammar Schools.**

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**SPELLING AND PENMANSHIP**

Writing from dictation a paragraph or two of some standard text—Irving's Rip Van Winkle or Bancroft's United States History.

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**GRAMMAR**

- I.—Use each part of speech in a different sentence, indicating the part of speech used in each sentence by underscoring and naming it.
  - II.—Define and give an example of a simple sentence, of a complex sentence, and of a compound sentence.
  - III.—Parse the italicized words in the following sentence: "By not heeding the *counsels* of our elders, *how* often do we *lose what* we should gain!"
  - IV.—Analyze the following sentence: "If we send the sailors a message in time, they will help us when the savages attack us."
  - V.—Write sentences illustrating the correct use of any perfect tense of each of the following verbs: sit, set, seat, lie, lay, write, go.
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**COMPOSITION**

The subject set is a description of some well-known place or object, or an account of some historical event.

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**UNITED STATES HISTORY**

1. What country was each of the following explorers serving when he came to America, and what territory did he discover or explore: Columbus, De Soto, Drake, Cartier?

2. Locate the settlements of the French, the Spanish, the Dutch.
3. Give a brief account of the settlement of Maryland.
4. Give a brief account of the wars between the English and French, extending from 1689 to 1763. State causes and results.
5. (a) State several causes of the Revolutionary War. (b) Name four important battles of the Revolution, and give a brief account of each.
6. What were the "Articles of Confederation," and why, and by what, were they superseded?
7. What is meant by "The Missouri Compromise?"
8. Name the principal causes of the Civil War. Who commanded on each side at Gettysburg? Why was the battle of Gettysburg so important?
9. What reason did the United States assign for going to war with Spain in 1898? What territory did the United States acquire as a result of that war?

#### ARITHMETIC.

1. Divide 5.375 by 0.0125, obtaining the exact result.
2. Simplify  $\frac{1 + 0.5}{1 - 0.5} \times \frac{0.05 \div 0.005}{0.005 \div 0.05} - \frac{0.4\frac{1}{2}}{0.22\frac{2}{3}}$
3. A merchant's sales on Monday amounted to \$385.84. His sales on Monday were  $16\frac{2}{3}\%$  of 54% less than the amount of goods sold on Tuesday. What was the amount of Tuesday's sales?
4. A firm sold an engine for \$7,050, thereby losing 6%; for what should it have been sold in order to gain 12%?

#### ALGEBRA.

1. Factor the expressions:  $a^2 + 6ar + 5r^2$ ,  $n^{10} - 16n^5 - 80$ , and  $1 - 9r - 36r^2$ .
2. Simplify  $\left[ (a^2 - r^2) \div \left( \frac{1}{r} - \frac{1}{a} \right) \right] - \left[ (a^2 - r^2) \div \left( \frac{1}{r} + \frac{1}{a} \right) \right]$ .
3. Given  $\frac{2r+1}{5} - \frac{3r+2}{7} = 2y - r$ ,  $\frac{3r-1}{4} + \frac{7y+2}{6} = 2r - y$ , find the values of  $r$  and  $y$ .

## CATALOGUE OF STUDENTS.

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Students whose names are marked with an asterisk (\*) received 85% or more of the possible multiple for the year.

### MID-YEAR CLASS OF 1912 — 24 MEMBERS.

Bobb, John G.	Lotz, Paul L.
Boucher, Oliver	MacCarthy, F. Harrison
Clancy, John J. Jr.	McConnor, William F.
Cooper, T. Earle	Michel, Fred.
Cullen, James A.	Parrott, William J.
Dankmeyer, Paul R.	Porter, G. Harvey
Darrington, Paul	Quast, Walter F.
Goetze, Frederick T.	Schad, Harry
Iglehart, Edgar M.	Seibert, Edward C.
Kearney, Cyrus J.	Snyder, William T.
Kemp, Milton	Tobias, Abraham
Krumm, Henry F.	White, Paul H.

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### CLASS OF 1912 — 90 MEMBERS.

Andrae, William C.	Danzig, Hyman G.
Atwell, R. Nelson	DeHuff, Mark S.
Bartholow, J. Carroll	*Dennis, Charles E.
Becker, John	Drenning, Richard P.
Beneze, George	Duncan, E. Gorsuch
Birnbaum, Clarence	*Eby, Samuel H.
Brownley, Arthur F.	Ehlers, Louis W.
Burton, Lyle H.	Eichelberger, Thomas S.
Cassell, W. Logan	Elliott, Howard
Chew, Howard W.	Emich, C. Clinton
Cloward, Davis J.	Ewell, H. Stockton
Cohen, Hyman A.	Finnan, J. Carroll
Constam, Earl A.	Fitzell, C. Edwin
Cromwell, Howard T.	*Frey, Albert

- Fried, Harry  
\*Fulton, Arthur D.  
\*Gagneux, Alfred M.  
Galvin, Sydney F.  
Gartside, Frank T.  
Goldberg, Harry A.  
Gover, Robb  
Graham, William S.  
Gusdorff, Sylvan  
Hacker, Theodore W.  
Harrison, Walter V.  
Heimiller, William J.  
Heineman, Karl J.  
Hesse, J. Wilbur  
Horn, Carl H.  
Kelly, Kenrick  
Koons, Paul B.  
\*Krieger, Abraham N.  
Kroll Irvin G.  
Lasinsky, Benjamin  
Lentz, Francis  
Link, Eugene B.  
Lucke, Frank  
Long, Raymond T.  
Meikle, A. Craig  
\*Mengers, Charles A.  
\*Michel, Rudolph  
Munroe, William H.  
\*Niles, Alfred S., Jr.  
Osenburg, Charles E., Jr.  
\*Parlett, Raymond C.  
Poole, Edward S.  
Rasch, Gustav A.  
Reynolds, Elmer C.  
Riley, James J.  
Roschen, Henry H.  
\*Sandlas, William H.  
\*Schad, J. Albert  
Schloss, Lester A.  
\*Schmeid, Eric E.  
Schuster, Howard J.  
Seal, Hanson  
Shilling, Louis E.  
Sternberg, John A.  
\*Stivers, E. Raimon  
Talbot, Edwin M.  
Talbot, Medford G.  
\*Thomas, Edward J.  
Traub, Frederick C.  
Travers, Oliver  
Unglaub, Spencer S.  
\*Walsh, J. Leonard  
\*Walter, H. Sigurd  
Ward, Rowe C.  
Warner, Andrew E.  
Watkins, Charles B.  
Webb, James S.  
Webster, Ormsby P.  
Williams, Chrystal  
Wisthoff, Reuben  
Wolfe, T. Robey  
Zscheuschler, Ernest C.

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MID-YEAR CLASS OF 1913 — 47 MEMBERS.

- \*Bacharach, Abram F.  
Baldwin, Lawrence A.  
Bigelow, G. Orville  
Boone, Carlyle E.  
Borst, Edward W.  
Brodie, Leigh H.  
Carter, Frank H.  
Cesky, Frank A.  
Cline, Ralph H.  
Collett, Harry A.  
Davis, E. Stanley  
Ehrhardt, C. Raymond  
Elgert, Elmer J.  
Garrett, Curtis L.  
Hall, Spencer  
Hampson, Edward A.

Heiner, John N.	Moore, W. R., Jr.
Heisse, Clarence	*Morrison, Carroll F.
Hess, Walter	Parks, Gordon T.
Hopkins, James	Pruett, Clifton
Houghton, Stedman	Pumphrey, Charles L.
Isaacs, Isidore	Smith, Milton
Jamison, Thomas W.	Tapscott, William A.
Kaiser, E. E.	Thomas, S. Le Roy
*Kaspar, Laurence C.	Trautman, Bernard J.
Kellinger, William J.	Tretick, Isaac
Korff, Harry	Wood, William E.
Leineweber, William F.	Walker, C. H.
Lenderking, L. T., Jr.	Walker, William F., Jr.
Levine, Julius	Ward, Raymond
Michaelson, Louis	Webb, Charles F.
Milburn, Paul B.	

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CLASS OF 1913 — 108 MEMBERS.

Abercrombie, William T.	Fusselbaugh, R. Reardon
Alcarese, Alphonso	Gephart, George F.
Ashley, Lloyd W.	Gilpatrick, Lawrence F.
Bailliere, F. Lawrence	Goldberg, Benjamin
Barnes, R. Kenneth	Graham, William McL.
Beaumont, C. Rawlings	Graulung, Charles H.
Becker, Charles A.	Greer, Robert Tyson
Boyer, J. Milton	Gross, Charles F.
Bratt, William Wallace	Gunts, Robert F.
Carlton, A. Clifford	Haderman, George K.
Chandlee, Theodore M.	Hamm, Otto H.
Clayton, A. E.	Hart, Robert M.
Clayton, Edwin C.	Heaphy, William
Cohen, Solomon	Hechmer, Earl A.
Collins, Laurence E.	Hicks, Robert
Davis, Parlett	*Hill, John B.
Day, Hugh Walter	Hiss, Charles A.
Disney, Leroy R.	Hoffman, Irving H.
Duvall, Elmer E., Jr.	*Houghton, Ira L.
Earle, Clarence E.	Hull, George E.
Emich, H. Crawford	Johnson, Elmer Y.
Fleischman, Leonard	Kauffman, James B.
Friez, Lucien L.	Kirwan, Emory, Jr.

Klitch, Alexander	Quinan, Allen J.
Kuehle, William F.	*Ramirez, Reinaldo
Kuehn, Edward J.	Raap, Raymond A.
Lang, George E.	Reiner, Milton
Lentz, Gustav	*Reinhardt, Frank G.
Levin, Jacob	Reinicker, Lawrence T.
Levis, Alfred C.	Rodgers, Henry P
McAllister, J. Wardale	Sarbacher, J. L.
*McCabe, Arthur S.	*Schad, Theodore G.
*Markley, Cyril	Schloss, Benjamin
Matusevitz, Edward	Schwartz, William F.
Messersmith, Paul	Sebald, Leslie
Meyerhoff, Louis	Seidel, John J.
Meushaw, W. T.	*Sheckells, Robert W.
Miller, Harry	Simon, Walter
Miller, L. W.	Sinclair, Carroll T.
Mueller, Edgar A.	*Sindler, Jacob
Mullikin, Cecil H.	Sohl, J. Rogers
Nunn, Edward H.	Thompson, H. L.
*Osbourn, William H.	Tschudy, Ernest
Panettiere, Vincent	Van Vleck, Pierce
Peacock, Edward	*Wacker, Hermann
Peddicord, Kenneth L.	Waldkoenig, George E.
Peregoy, J. Eldren	Waller, James M. S.
Platt, Landra Beach	Weatherly, Carroll D.
Poloway, Isaac	Wherrett, W. Norman
Porter, R. Lee, Jr.	Wilhelm, W. H.
Poumairat, Charles H., Jr.	*Williams, John A.
Preston, J. Owings	*Wroe, W. Clarke
Pyle, Milton A.	Yearley, Edwin C.
Pyle, O. B.	Ziefle, Howard E.

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 MID-YEAR CLASS OF 1914 — 48 MEMBERS.

Armstrong, M. Albert	Conway, Paul T.
Benfer, Wilbur E.	Dashiell, B. Francis
Bien, Samuel John	De Marco, John L.
Bohannon, Joseph S.	Dimling, George J.
Burnsall, William G.	Dippoldsman, Henry
Carmichael, George W.	Elliott, George H.
Chusman, Edward	Fahlen, R. Norman
Clemmitt, Paul	Finklestein, Ellis

Fluharty, Thomas J.  
 Harman, George D.  
 Hartman, Lester  
 Heimiller, M. Maurice  
 Hicks, E. Russell  
 Houck, Charles W.  
 Keimig, William Leslie  
 Klingelhofer, H. L.  
 Knight, Clarence D.  
 Korpman, Harry W.  
 McGinnis, Joseph  
 McLaughlin, Harvey F.  
 Machen, S. Raymond  
 Manger, Charles E.  
 Millar, Donald A.  
 Moltz, Leonard C.

Paulus, Edward J.  
 Poehlman, James E.  
 Reitz, Robert A.  
 Robinson, Harry L.  
 Rodemeyer, Graham  
 Rudis, V. Vyant  
 Sarbacher, William H.  
 Spies, Arthur T.  
 Von Eiff, Herman A.  
 Warner, Wallace  
 Weis, G. L. Wellington  
 \*Weissing, Louis  
 Wilson, Vance Vernon  
 Wolman, Sidney N.  
 Woodall, James H.  
 Wrenn, J. Edwin

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CLASS OF 1914 — 226 MEMBERS.

\*Adams, Albert C.  
 Adams, Arthur J.  
 Aldridge, James H.  
 Amoss, Jarrett S.  
 Anderson, Richard W.  
 Andrae, Charles W.  
 \*Awalt, Lloyd F.  
 Barrett, Julian B.  
 Beacham, Frederick B.  
 Berlin, Benjamin  
 Benson, John O.  
 \*Bishop, Gordon K.  
 \*Black, C. Warren  
 \*Bloomsburg, Ralph A.  
 Bondy, Edward W.  
 Brandt, Charles E.  
 \*Bristor, Charles E., Jr.  
 Brown, F. Lorin  
 \*Burns, Charles W.  
 Buxton, Nelson F.  
 Carr, William R.  
 Childs, Walton B.  
 Chism, Edward K.

Clark, Percy  
 Clark, Thomas S.  
 Cochran, James E.  
 Collison, Vernon  
 Constam, Milton M.  
 Cooper, Louis  
 Cooper, Oliver D.  
 Corner, Frank  
 \*Coursey, George C.  
 \*Crist, Frank  
 Cromwell, Stanley S.  
 \*Cullom, Kenneth S.  
 Cupit, Harold  
 Davis, H. Rogers  
 Davis, William N.  
 Day, Stanley E.  
 Dempster, Ryland  
 De Muth, C. Raymond  
 Denhard, Leroy  
 Derr, Brant S.  
 Dinsmore, Thomas M.  
 Dischler, Gordon  
 Ditman, Rothwell

- Duck, William E.  
 Edel, Walter L.  
 Eisele, Karl  
 Eliason, Henry C.  
 Elbert, David, Jr.  
 Ernest, George E.  
 \*Ewell, Frank O.  
 Fallowsfield, T. Paul  
 Farley, Joseph  
 Fort, Alfred  
 \*Fox, Charles  
 Freeman, Stanley P.  
 Friend, Walter A.  
 Forst, Edward A.  
 Gale, Henry O.  
 \*Gerhardt, William F.  
 Gessford, Joseph, Jr.  
 Glantz, Irving F.  
 Gompf, John W.  
 Green, Ernest J.  
 \*Greenberg, Harry  
 Gupta, Leonard L.  
 Gundersdorf, Nelson  
 Haddock, Hugh L.  
 Hamill, Frank J.  
 \*Hardinge, Thomas H.  
 Harris, Robert T.  
 Harrison, Horace B.  
 Haskell, Lee C.  
 Hedden, Ralph V.  
 Hedrick, Melvin  
 Heinmiller, Howard  
 Heinmiller, Paul  
 Helm, Edward C.  
 Hennick, Donald C.  
 Hess, J. Elmer  
 Hoffman, Charles E.  
 Hoffman, George A.  
 Hoffman, H. Lee  
 Hogan, Harold O.  
 Hogg, John W.  
 Holke, William B.  
 Hollander, Louis J.  
 Howard, Stanley L.  
 Hoss, Philip E.  
 Hutchinson, Frank  
 Isaac, Frank R.  
 Jackson, W. Irvin  
 \*Jacobs, Joseph  
 Jenkins, Leonard D.  
 Joyce, Temple N.  
 Kalling, Lewis J.  
 Keagle, Walter J.  
 Kellner, H. Irvin  
 Kemo, Wilbur  
 Kelly, Paul B.  
 Klawans, Edward  
 Knabe, Karl L.  
 Kohlnepp, C. Elmer  
 Kohner, Emanuel  
 Kounta, Lionel E.  
 Krieger, Joseph E.  
 Kronee, Benjamin A.  
 Lapetina, Peter  
 Lawrence, William R.  
 Lerner, Harold  
 Leonhardt, Carl O.  
 Leonhardt, Milton D.  
 \*Leskawa, Henry J.  
 Linhardt, Otto C.  
 Linthicum, Maynard J.  
 Long, Albert V.  
 Loweree, Paul A.  
 Lutz, James  
 McAuliffe, Cornelius  
 McKay, Wilbur S.  
 McShane, John M., Jr.  
 Milboone, Lloyd L.  
 Mansfield, Arthur R.  
 \*Mason, Charles E., Jr.  
 Mason, Richard C., Jr.  
 Mealy, J. K.  
 Meisinger, Norman G.  
 Meeth, John T.  
 Merritt, J. Levering  
 Merry, Edward T.  
 Meyers, Charles W.  
 Milbourne, E. Russell  
 Miller, Eugene W.  
 Milner, Robert

- \*Moreton, Spencer  
 Moore, William W., Jr.  
 Morrison, Walter H.  
 Mosher, William B.  
 Moxley, Reuben B.  
 Murchison, David  
 Myers, Robert N.  
 Nengel, Theodore  
 Nisberg, Frank  
 Page, Edward L.
- \*Parsons, Harry  
 Patzschke, William C.  
 Pfeifer, Raymond S.
- \*Pfeil, August  
 Phillips, George P., Jr.  
 Platt, Walter E.  
 Poettier, William R.  
 Preston, William F.  
 Price, Augustus R.  
 Reese, William A.  
 Reibetanz, Edgar F.  
 Renno, Paul C.  
 Rice, John Wade  
 Rittase, Elmer H.
- \*Robertson, Howard L.  
 Robinson, Jenkins A.  
 Rowland, Henry A.  
 Schloer, Frank N.  
 Schmidt, C. Raymond  
 Schmidt, Henry R.  
 Schobel, Charles O.  
 Schumacher, Reuben B.  
 Schwartz, Frank  
 Scott, John S.  
 Seidenman, Ellis  
 Seidewitz, Edwin W.  
 Seippel, John H.  
 Seitz, Monroe  
 Shew, Brent
- \*Shilovitch, Nathan  
 Silberstein, Eli  
 Smart, L. Landon  
 Sioman, Harold  
 Smith, Boulden  
 Snyder, W. Overton, Jr.
- \*Spencer, Raymond D.  
 Spansbury, John S.  
 Steinwedel, Edwin A.  
 Stewart, Robert J. H.  
 Stewart, William L.  
 Stokes, John A.  
 Soudenmire, Laurence  
 Strobel, Peyton B.  
 Szechlan, William T.  
 Stummeyer, William F.  
 Stumpener, A. G.  
 Summers, Lindner T.  
 Talbot, George G.
- \*Talkin, Harry
- \*Taylor, R. Corbin  
 Tearney, Joseph F.  
 Thayer, James S.  
 Thiess, Ferdinand F.  
 Thomas, Charles B.  
 Thompson, Charles L.  
 Tilmann, Daniel W.  
 Townsend, William Guy  
 Trageser, Charles A.  
 Tregoe, Benjamin
- \*Trigg, Charles W.  
 Trimble, James R.  
 Wagner, Julian T.
- \*Ward, Henry Clay  
 Ward, Wilbur F., Jr.
- \*Weant, Clarence H.  
 Weeks, Walter E.  
 Weinberg, Samuel  
 Welsh, Raymond M.  
 Whaley, W. Monroe  
 Whiteman, Rogers C.  
 Weidefeld, Arthur  
 Willhode, Paul A.  
 Wilner, Samuel  
 Wohn, Harry  
 Wolf, Paul B.  
 Wright, Ralddolph K.  
 Yingling, F. Clifton  
 Young, Douglas E.
- \*Young, E. Carl  
 Zimmerman, Emmett H.

## MID-YEAR CLASS OF 1915 — 79 MEMBERS.

Adams, Robert	McDonough, A. Wilford
Anderson, Edward	McGinnis, Herbert
Beers, Fred. C.	McLeod, David R.
Bosworth, Russell D.	Masbach, P. Harold
Boyd, H. Edwin	*Munroe, Everett
Boyer, Howard	Neavitt, E. Hall
*Breyer, Ralph	*Necker, Louis
Butler, Edward E.	New, Charles W., Jr.
Carroll, Earl	Orban, Frank
Chatterly, Douglas	Ostheim, H. Seibert
Clisham, James	Panettiere, Cayetano
Collmus, Selway	Phipps, Allen
Darley, Lea A.	Purdy, Egbert
Dashiell, Richard M.	Price, Alan
*Dempster, John S.	Prinke, C., Jr.
Denny, Joseph M.	Quick, Roland S.
Depralon, Arthur	Renno, Arthur A.
Drummond, W. Edwin	Renner, Earl
Dushane, Charles, Jr.	Russell, Harry
Ehlers, William, Jr.	Schloman, W.
Frizzell, James, Jr.	Shamer, George
Gillespie, James M.	Sherwood, Irving
Gilpin, Levering	Shew, Harry F., Jr.
Goldstein, Abraham	Smith, Deleaf
Green, Fred.	Smith, George
Greenwald, Sidney	Smith, Raymond
Hollstein, Arthur W.	Smyth, Joseph
Houdeshel, Howard	Thomas, Harry
Huhn, Augustus, Jr.	Tompkins, Edwin L.
Jennings, Carey	Tucker, Albert L.
Johnson, Bradley T.	*Turner, Wadsworth
Johnson, Joseph	Tyler, Arthur
Kabernagel, Alfred	Vordemberge, De Lancy
Kaufholz, Robert M.	Walter, Jasper
Kittrell, Allen	Weaver, Willis G.
Koffenberger, Charles	Weigand, Philip
Krebs, John	Wolf, Russell
Krotee, Harry	Zenitz, Nelson
Lang, Richard	Zieffe, H. Paul
Lawrence, J.	

## CLASS OF 1915 — 391 MEMBERS.

Addison, Walter W.	Brown, Thomas M.
Albaugh, James A.	Brust, Fred. L.
Allison, Robert A., Jr.	Bull, Paul L.
Ammer, Clarence	Burgess, Harry J.
Anderson, Gunnar W.	Burkhardt, Howard
Anger, Albert E.	Burner, Russel K.
Armiger, Herbert	Burnham, Kenneth
Armiger, William J.	Burrier, Henry W.
Aronson, Samuel	Caldwell, Lee R.
Baer, B. Frederick	Callowhill, Harold S.
Baker, Marion	Caltrider, Archibald
Baker, O. Parker, Jr.	Campbell, Lawrence O.
Ballard, Donald D.	Carr, Aloysius
Barsotti, Alphonsus	Charvat, Thomas
Basehart, Arthur R.	Childs, Frank
Bassett, Daniel M.	Chipchase, James B.
Bauer, George C.	Chipman, Joseph
Bauernschmidt, R. L.	Clarson, Robert
Bauersfeld, George W.	Clifton, Ralph C.
Baxter, William C.	Cohen, Samuel
Baylin, Joseph	Cole, Walter M.
Becker, George	Compton, Key
Beetham, Curtis	Constam, Henry
Behrens, Carl A.	Cooling, Henry L.
Benson, Carl	Cooper, Carroll
Bentz, Arthur G.	Crandell, Raymond A.
Bentz, William L.	Crawford, William F.
Bernstein, Benjamin	Currie, Kent D. D.
Bishop, Russell G.	Cushen, Harry P.
Bitter, Kenneth O.	Daiger, Joseph P.
Bittorf, Henry J.	Damico, Vincent
Blatchley, Norman	Dawson, Charles R.
Blaustein, Herbert	Davis, Allen V.
Blazek, Charles J.	Davis, George W.
Bloom, Abraham	Davis, Ewell
Bourne, Earl T.	Deal, Milton H.
Bowen, John W., Jr.	Deichmiller, Alvin
Bramble, Arthur E.	Denhard, Elbert E.
Braun, Christian	Dennis, Percy D.
Brian, Carville J.	Dessel, George
Brill, Charles N.	Diehl, Richard S.
Brown, Stewart	Dietrich, Elmer M.

- Dietrich, Reese  
Dietz, Harry H.  
Dinkelman, Carl M.  
Dill, Henry H., Jr.  
Donohue, Leo D.  
Downie, Donald S.  
Doyle, James  
Duncan, William W.  
Eager, Paul R.  
Eagleston, George  
Easter, Andrew J.  
Eben, Robert L.  
Eden, John B.  
Eisenbrandt, Fred. H.  
Eisert, L. William  
Ellis, Newton R.  
Eisenhardt, Karl J.  
Elsnic, Frank  
Emory, Charles R.  
Engel, John G.  
Ensor, William L.  
Erck, Charles F.  
Esterson, Max  
Feldman, Walter H.  
Fields, William W.  
Finklestein, Isidore  
Flayhart, Edward  
Forrest, Otto N.  
Francis, Robert N.  
Frantz, Derbert R.  
Freeman, Hyman G.  
Freol, Edward F.  
Friedman, Hyman  
Fusselbaugh, Robert, Jr.  
Gail, Emil J.  
Galloway, William E.  
Garner, Arthur  
Garrett, Roland  
Gemmill, Hamilton  
Getterman, George W.  
Gier, Frank  
Gittinger, Alexander B.  
Givner, Abraham  
Glaser, Alfred W.  
Glashoff, Irving  
Glick, Morris  
Goldman, Arthur S.  
Goldman, Louis  
Goldstein, David  
Gompf, George  
Gore, William H.  
Greenbaum, Isaac  
Greer, Bryan  
Gressitt, William G.  
Grieb, Christian  
Griffiss, James E.  
Haile, Le Roy Y.  
Hall, Reginald I.  
Hampsher, William L.  
Hanft, Robert B.  
Hank, James C.  
Harden, William C., Jr.,  
Hardin, John R.  
Hardy, Edward  
Hardy, Harry C.  
Hargreaves, Arthur C.  
Harvey, Charles H.  
Haskell, Crawford R.  
Hasson, Leonard V.  
Hastings, Warren  
Hauer, Harry E.  
Hause, Robert L.  
Hauswald, Carl C.  
Hax, Herbert  
Heddinger, Charles  
Heller, Morris S.  
Hempel, William J. F.  
Henzler, George  
Herr, Robert M.  
Hertel, Albert  
Heuisler, Harry  
Hipsley, Preston  
Hobbs, Elmer H.  
Hoblitzell, Richard G.  
Hodlecko, Charles, Jr.  
Hoffman, Oeds V.  
Hohman, Conrad  
Holden, Urban S.

- Hook, Leroy J.  
Horlebein, Edwin W.  
Houck, Frank G.  
Hubbard, William F.  
Hunt, James  
Hunter, Herbert T.  
Hutchins, Richard  
Ilgenfritz, Milton  
Jackson, Royston E.  
Jenkins, Talbot  
Jennings, H. Carroll  
Joslin, John A., Jr.  
Joyner, Norman  
Kaestner, Albert  
Kaiser, Charles A.  
Kaspar, Charles J.  
Keller, Samuel E.  
Kemler, Thomas G.  
Kemp, Charles T., Jr.  
Kenny, Raymond  
Kimmel, Lewis E.  
Kirkley, Stanhope S.  
Kirwan, Mason L.  
Klemm, Gustav W.  
Klimm, Leroy  
Klunk, Frank  
Knecht, John  
Knoop, Fred.  
Koerber, Frederick  
Korpman, Walter W.  
Kresser, Samuel L.  
Kronthal, Jacob  
Krug, Willam F., Jr.  
Lampe, John H.  
Landefeld, Edgar  
Lardusky, James L.  
Larrabee, William F.  
Lasinski, Frank P.  
Lau, John H.  
Lauten, William B.  
Laux, G. August  
Lawrence, Wallace  
Lazenby, Joseph D.  
Lease, John W.  
Lehr, William E.  
Leineweber, C. Everett  
Levine, Jacob  
Levy, Isidor  
Levy, Oscar  
List, George  
Little, Francis W.  
Locher, Rudolph W.  
Long, Benjamin  
Longley, Edward L.  
Luckett, P. Wilson  
McCallister, Samuel L.  
McCauley, William R.  
McCourt, Charles M.  
McCoy, Otis E.  
McDonald, George  
McGee, Earl M.  
McGinnis, Charles A.  
McQuinn, Charles E.  
Maguire, John J.  
Mahler, George L., Jr.  
Mansfield, Richard L.  
Marks, Harold L.  
Marsh, William A.  
Martin, William  
Masbach, Jean  
Mayo, Horace B.  
Melvin, James  
Mengert, Thomas  
Mihm, William A.  
Miller, Harold F.  
Miller, Harry A.  
Mills, William N.  
Moeser, William  
Mohlenrich, Henry C.  
Moore, Fred. William  
Moore, J. Duncan  
Moore, Robert  
Morrison, Herbert K.  
Mowry, Albert A.  
Muir, Joseph A., Jr.  
Mullen, Herbert  
Naeny, Albert H.  
Neal, Roland W.

Nicholson, Calvin B.	Sanner, John W.
Nicols, John L.	Sater, Carlton B.
Noel, Norman	Satil, Abraham
Novak, Frank	Schmidt, Carl W.
O'Keefe, Irving	Schumann, George
O'Keefe, John J.	Schumann, Webster E.
Oldershaw, Samuel E.	Scott, James F.
Oliver, Harold D.	Sellman, Lee W.
O'Neill, George O.	Seltzer, Eugene P.
O'Neill, Roland I.	Sener, Beverley T.
Oppenheim, Maurice	Seymour, Samuel T.
Ortman, Carl C.	Shanklin, Arthur P., Jr.
Paige, Edward R.	Shanklin, Richard G.
Pawley, Howard	Sheely, Raymond
Payne, Ralph C.	Sheridan, Richard C.
Payne, Raymond E.	Sherlock, Carlton P.
Peters, Stuart A.	Shriner, Clarence E.
Petrick, Edward	Sieck, Claymore C.
Pfaff, Rudolph	Sinclair, Preston S.
Phillips, George T.	Sinclair, Walter
Picker, Kumbert	Singewald, Paul H.
Pivarnick, Eli	Skinner, Claude M.
Powell, John	Slasman, William H.
Prem, Raymond H.	Smead, Edwin J.
Preston, Charles R.	Smith, Anthony
Prince, Henry L., Jr.	Smith, Charles G.
Prince, Robert B.	Smith, Edward A.
Pryor, Robert L.	Smith, James
Rabl, Samuel	Smith, Robert F., Jr.
Ranft, William Q.	Smith, William A., Jr.
Raum, Harry	Snyder, Edwin
Rede, George R.	Spittel, Robert J.
Reimer, John	Startzman, Henry H.
Rhode, Russell M.	Stevens, William D.
Riepe, Harry U.	Stirling, David S.
Robbins, John R.	Storm, Milton O.
Rogers, Alfred K.	Strahler, Louis J.
Rohowski, Joseph, Jr.	Struven, Albert L.
Rombro, Benjamin	Sutton, Edgar K.
Rosenthal, Jacob S.	Terry, William T.
Roth, Louis H.	Thomas, John R.
Rowley, Joseph A.	Thomas, William
Rudo, Zoorah	Thompson, Charles E.
Sabsewitz, Benjamin S.	Thompson Lawrence

Filghman, Robert N.	Weinberger, John
Tille, Karl F.	Wendel, Adam
Townsend, Francis H.	Wessels, Bernard T.
Treide, Carl L.	Wessels, Walter B.
Turner, Robert G.	Wheeler, Chester
Upman, Edgar A.	Wherley, Clarence V.
Upton, William K.	White, Chester
Van Pelt, Franklin C.	White, Herbert E.
Von Schulz, William M.	Whitehill, Morton S.
Vurnay, Walter H.	Wiland, Luther
Wailes, Edwin E.	Wildsmith, Thomas F.
Walger, Louis M.	Wilkinson, William B.
Wallace, Charles E.	Williamson, Marion D.
Warfield, Charles D.	Winters, John E.
Warner, Arthur W.	Wirtz, Lawrence V.
Warren, Elmer	Wolf, Dupont
Warren, Wilson C.	Wolf, Henry S.
Waterman, Sherwood	Wolf, Herman
Waters, Murray G.	Wooden, Dewey E.
Weaver, John E. R.	Wright, Howard P.
Weil, Joseph	Wright, Lawrence L.
	Wrightson, William H.

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MID-YEAR CLASS OF 1916 — 64 MEMBERS.

Altwater, Arthur E.	Harker, James J.
Born, E. Otto	Heinz, E. Clinton
Bruggemann, Herman	Hess, Leslie H.
Crout, Marvin M.	Hieatzman, Merrill M.
Dehler, Frank	Hofmeister, Charles P.
Easter, A. Johnson	Iddings, Llewellyn L.
Eby, Harry S.	Jarvis, Carryl H.
Erck, Henry G.	Keese, Maurice J.
Ermold, Herbert L.	Kirk, Leroy A.
Feast, Harry C. L.	Knight, Joseph
Fitch, Arthur S.	Konstant, Nick A.
Franz, Rudolph	Lean, James T.
Freeland, Millard I.	Lutzky, Bernard
German, Thomas R.	Lyspy, Frank
Glascock, Turner A.	Lowenstein, Frederick
Greenspun, Joseph	McGarvey, Julian A.
Greisz, Joseph O.	Mowbray, Otley

Neubauer, John J.	Shockley, William B.
Neumeister, Fred.	Slingluff, Lee H., Jr.,
Noha, Charles M.	Smith, Lee L.
Parran, James H.	Smith, Paul E.
Pearson, William P.	Thompson, A. Clarence
Poehlman, George I.	Vogedes, William
Quarles, Giles W.	Waddell, William
Reindollar, Edward	Walter, Charles
Richmond, Sidney	Weil, Louis
Ridley, Clinton L.	White, Charles P.
Robinson, Christopher S.	White, John G.
Rosenfeld, Norman E.	Wiesner, Henry F.
Rowley, Joseph	Wilson, Raymond J.
Schimmel, Richard	Wood, Lukens
Shipley, Wesley	Woodall, Robert E.

## SUMMARY OF ENROLLMENT.

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Mid-Year Class of 1912.....	24
Class of 1912, A Class.....	90
Mid-Year Class of 1913, A-x Class.....	47
Class of 1913, B Class.....	108
Mid-Year Class of 1914, B-x Class.....	48
Class of 1914, C Class.....	226
Mid-Year Class of 1915, C-x Class.....	79
Class of 1915, D Class.....	391
Mid-Year Class of 1916, D-x Class.....	64
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Total enrollment.....	1,077

## CLASS ORGANIZATIONS.

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### CLASS OF 1912—A CLASS.

<i>President</i> .....	H. Sigurd Walter.
<i>Vice-President</i> .....	Theodore W. Hacker.
<i>Secretary</i> .....	Davis J. Cloward.
<i>Treasurer</i> .....	Walter V. Harrison.

### MID-YEAR CLASS OF 1913—A-x CLASS.

<i>President</i> .....	Walter Hess.
<i>Vice-President</i> .....	Harry A. Collett.
<i>Secretary</i> .....	Carlyle E. Boone.
<i>Treasurer</i> .....	Stedman Houghton.

### CLASS OF 1913—B CLASS.

<i>President</i> .....	Charles A. Becker.
<i>Vice-President</i> .....	Hugh W. Day.
<i>Secretary</i> .....	John A. Williams.
<i>Treasurer</i> .....	Elmer E. Duvall, Jr.

### MID-YEAR CLASS OF 1914—B-x CLASS.

<i>President</i> .....	Louis Weissing.
<i>Vice-President</i> .....	E. Russell Hicks.
<i>Secretary</i> .....	Vance V. Wilson.
<i>Treasurer</i> .....	Thomas J. Fluharty.

### CLASS OF 1914—C CLASS.

<i>President</i> .....	Joseph Jacobs.
<i>Vice-President</i> .....	Walter L. Edel.
<i>Secretary</i> .....	Charles E. Mason, Jr.
<i>Treasurer</i> .....	Benjamin Tregoe.

## MID-YEAR CLASS OF 1915—C-X CLASS.

<i>President</i> .....	Harry F. Shew, Jr.
<i>Vice-President</i> .....	Robert Adams.
<i>Secretary</i> .....	Albert E. Tucker.
<i>Treasurer</i> .....	Richard Lang.

## CLASS OF 1915—D CLASS.

<i>President</i> .....	Lawrence O. Campbell.
<i>Vice-President</i> .....	Stewart Brown.
<i>Secretary</i> .....	Robert Fusselbaugh, Jr.
<i>Treasurer</i> .....	Walter W. Addison.

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LITERARY SOCIETIES.

## The "Lowell."

<i>President</i> .....	Lewis W. Miller, '13.
<i>Vice-President</i> .....	William H. Sandlas, '12.
<i>Recording Secretary</i> .....	I. Luther Houghton, '13.
<i>Corresponding Secretary</i> .....	Frederich Michel, '12.
<i>Treasurer</i> .....	Vincent Panettiere, '13.
<i>Sergeant-at-Arms</i> .....	E. Stanley Davis, '13.
<i>Reporter</i> .....	Abram F. Bacharach, '13.
<i>Executive Committee</i> .....	{ Carroll F. Morrison, '13.
	{ E. Russell Hicks, '14.
	{ The President, <i>ex-officio</i> .
<i>Critics</i> .....	{ Mr. George S. Wills.
	{ Gustav A. Rasch.

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The "Poe."

<i>President</i> .....	F. Harrison MacCarthy, '12.
<i>Vice-President</i> .....	Walter Harrison, '12.
<i>Secretary</i> .....	Edward S. Poole, '12.

<i>Treasurer</i> .....	H. Sigurd Walter, '12.
<i>Reporter</i> .....	J. Wilbur Heisse, '12.
<i>Historian</i> .....	W. Taylor Abercrombie, '13.
<i>Librarian</i> .....	R. Lee Porter, '13.
<i>Sergeant-at-Arms</i> .....	Paul Koons, '12.
<i>Critic</i> .....	Mr. William P. Stedman.
<i>Executive Committee</i> .....	{ Oliver Boucher, '12. George Beneze, '12. The President, <i>ex-officio</i> .
<i>Business Committee</i> .....	{ E. Raimon Stivers, '12. Solomon Cohen, '12. The Vice-President, <i>ex-officio</i> .

On April 1, 1911, the debating team of the Poe met the representative team of the Bancroft Literary Association of the Baltimore City College for the interscholastic championship. The subject debated was: "Resolved: That for Baltimore the Mayor and Council Form of Municipal Government Is Preferable to the Commission Form." The Bancroft team upheld the affirmative, while the Poe team, composed of Davis J. Cloward, E. Raimon Stivers, F. Harrison MacCarthy, and Solomon Cohen (alternate), supported the negative side of the question. The judges, Dr. Edward F. Buchner, Mr. Morris A. Soper, and Dr. George F. Barnett, rendered a unanimous decision in favor of the negative side.

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## THE POE-LOWELL JUNE PLAY.

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The Poe and the Lowell Literary Societies combine each year to present some dramatic performance during the commencement week. In doing this they are actuated by the desire not only of benefiting themselves intellectually by the training they receive in preparing for and in producing their play, but also by a desire to give to their friends a pleasant evening, and to bring before the people of Baltimore the literary activities of the Institute.

"His Excellency the Governor," a three-act farce by Capt. Robert Marshall, was presented by the combined societies, at Albaugh's Theatre, on the evening of June 23, 1911. The cast was a large one, as follows:

A butler.....	John Bohnlofink, '11
Footmen.....	{ John Sendelbach, '11 William G. Richardson, '11
Mr. John Baverstock, private secretary..	Alfred B. Smith, '11
Captain Charles Carew, on His Excellency's staff,	Howard J. Schuster, '12
A clerk.....	W. Taylor Abercrombie, '13
His Excellency Sir Montagu Martin, G. C. S. I., Governor of the Amandaland Islands, J. Frederick Gross, '11	
A rickshaw man.....	C. Elmer Reynolds, '12
Stella de Gex.....	F. Harrison MacCarthy, mid-year '12
A sentry.....	E. Raimon Stivers, '12
The Right Honourable Henry Carlton, M. P.,	George W. Steinmetz, '11
Mrs. Wentworth-Bolingbroke.....	E. Russell Hicks, '13
Ethel Carlton.....	Otis Gray Wilbur, '11
Captain Rivers, } of the Midland {	John G. Bauernschmidt, '11
Major Kildare, } Fusiliers. {	Emory Kirwan, Jr., '13
Native servants.....	{ W. Taylor Abercrombie, '13 John Sendelbach, '11
	{ Walter Edel, '14 M. G. Talbot, '12 Albert Long, '14 H. Edwin Boyd, '14 J. Levering Merritt, '14 Hanson Seal, '12 W. Taylor Abercrombie, '13 W. N. Wherrett, '13
Soldiers.....	
Officer in charge.....	J. Nathaniel Heiner, '13

## SYNOPSIS.

Act I—The vestibule of the Government House, Ammandaland Island, Indian Ocean. Time—The present.

Act II—The same, now in the evening.

Act III—The same, later, the barricade removed.

## 1911 PLAY COMMITTEE.

Mr. William Perry Stedman.....*Stage Manager.*  
 William T. Snyder, '12.....*Asst. Stage Manager.*  
 J. Frederick Gross, '11.....*Chairman.*  
 W. Elwood Vail, '11.....*Treasurer.*  
 F. Harrison MacCarthy, '12.....*Secretary.*

Julius O. Ziegfeld, '11.	Wilson T. Ballard, '11.
Conrad Zieget, '11.	Davis J. Cloward, '12.
Charles Burlingham, '11.	Lewis W. Miller, '13.

## ATHLETICS.

## THE ATHLETIC ASSOCIATION.

The fundamental basis upon which rests the organization of the Athletic Association is the elevation of schoolboy athletics. It seeks to establish honor, self-restraint, and courage above victory. It provides suitable apparel and safety devices for contestants in order to lessen the chances of injuries, and endeavors to shape the coaching and training on hygienic principles. It permits any student of the Institute to become a candidate for any team or squad which represents the school in athletic contests, provided his scholastic standing is of the required standard.

The Athletic Board is so constituted in membership as to make it thoroughly representative of the student body.

## ORGANIZATION OF THE ATHLETIC ASSOCIATION.

<i>Honorary President</i> .....	Principal William R. King.
<i>President</i> .....	John A. Sternberg.
<i>Vice-President</i> .....	Landra Beach Platt.
<i>Secretary</i> .....	Paul Messersmith.
<i>Treasurer</i> .....	Mr. Samuel P. Platt.

## ATHLETIC BOARD.

Fred. Michel, '12.	Landra B. Platt, '13.
F. Harrison MacCarthy, '12.	James E. Poehlman, '14.
Davis J. Cloward, '12.	James H. Woodall, '14.
Albert H. Frey, '12.	Donald A. Millar, '14.
Arthur D. Fulton, '12.	Walter L. Edel, '14.
Charles A. Mengers, '12.	Ernest J. Green, '14.
John A. Sternberg, '12.	Joseph Jacobs, '14.
Abram F. Bacharach, '13.	Ralph Breyer, '15.
Carroll F. Morrison, '13.	Conrad Hohman, '15.
Paul Messersmith, '13.	Richard L. Mansfield, '15.
Frederick L. Bailliere, '13.	William H. Slasman, '15.
C. Rawlings Beaumont, '13.	Robert A. Allison, Jr., '15.
Hugh Day, '13.	Crawford R. Haskell, '15.
John B. Hill, '13.	Key Compton, '15.
Emory Kirwan, Jr., '13.	William R. McCauley, '15.

## BASEBALL.

The 1911 record of Polytechnic baseball, while not altogether successful, was commendable. The wet season necessitated the postponement of several games. The team was composed of:

Duncan, Buxton, and Dorsey, pitchers; Platt, Bobb, and McShane, catchers; Wilson, first base; Sweeney (captain), second base; Day and Demarco, shortstops; Kaufman and Earle, third base; Travers, left field; Kelly, center field; Barnes, right field.

Substitutes: Chism, F. L. Brown, Bristor, Lytle, Meikle, Bailliere, S. T. W. Green, Waller, Heimiller and Klingelhofer.

The following is a summary of games played:

Polytechnic.....	5,	Hopkins Medical Team.....	8
Polytechnic.....	0,	Tome Institute.....	7
Polytechnic.....	16,	Strayer's Business College...	0
Polytechnic.....	14,	Loyola College.....	11
Polytechnic.....	0,	Gallaudet .....	6
Polytechnic.....	15,	Country School.....	3
Polytechnic.....	4,	Calvert Hall.....	3
Polytechnic.....	7,	University of Maryland.....	2
Polytechnic.....	3,	Baltimore City College.....	4
Polytechnic.....	0,	Western Maryland College...	11
Polytechnic.....	8,	Loyola College.....	6
Polytechnic.....	3,	Washington College.....	9
Polytechnic.....	5,	Charlotte Hall.....	6
Polytechnic.....	1,	Baltimore City College.....	10
Polytechnic.....	2,	St. John's Reserves.....	3
Polytechnic.....	6,	Chester Athletic Club.....	6

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#### FOOTBALL.

The football season of 1911 was eminently successful, terminating in the defeat of the City College by the score of 6 to 0. This game was played on the Homewood field before a record-breaking crowd. It determined the interscholastic championship of the city, and in recognition of this a handsome banner was awarded the team, at the end of the game, by the Johns Hopkins University.

The successful season was due, mainly, to three things: The large squad which was maintained and its enthusiastic support by the student body; the use of the Mount Washington Club and grounds for practice, and the excellent coaching by Messrs. Harry Oehrl and A. K. Brumbaugh.

The opening game with the Mount Washington Club served as a practice try-out for the Polytechnic squad. The next game, with Gilman's Country School, was played in a heavy rain, making it a rather unsatisfactory contest. The game

with Rock Hill College resulted in the only decisive defeat of the season for the Polytechnic, but after that the team improved steadily up to the time of its final victory on November 23.

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#### THE TEAM.

Knight, left end; Sternberg, left tackle; Meikle, left guard; Messersmith, center; Kaiser, right guard; Sebald, right tackle; Yingling, right end; Chandlee, quarterback; Hamm, left halfback; Ewell, right halfback; Platt (captain), fullback.

Substitutes: Cassell, Day, Graham, Robinson, Weatherly.

The following is a summary of games played:

Polytechnic.....	0,	Mount Washington Club.....	5
Polytechnic.....	15,	Gilman's Country School.....	0
Polytechnic.....	0,	Rock Hill College.....	12
Polytechnic.....	3,	St. John's College Reserves..	0
Polytechnic.....	12,	Maryland Agr. Col. Reserves,	0
Polytechnic.....	9,	Episcopal High School.....	3
Polytechnic.....	29,	Charlotte Hall School.....	0
Polytechnic.....	6,	City College.....	0

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#### THE MARKSMEN'S CLUB.

The object of the Marksmen's Club is to create among the students an interest in marksmanship, that branch of athletics which develops a steady arm, a quick eye, and a manly self-reliance. It is composed of all the members of the school who can shoot, or who wish to learn to shoot.

The Club is a member of the National Rifle Association's League, composed of schools from all over the United States. In matches held during the past year by this Association, the Marksmen's Club made a very creditable showing. A number of members of the Club won silver lapel buttons of the National Rifle Association in testimony of their ability to shoot 38 stand-

ing and 42 prone, each out of a possible 50. The annual match of the Association for the bronze medal was won by Arthur D. Fulton.

The capping climax of the year happened, however, on February 17, 1911, when the Polytechnic Rifle Team decisively defeated its old rival, the City College Team, by 35 points, thereby winning the interscholastic championship of the city for the third successive year. A championship trophy was presented to the school by the National Sporting Goods Company, at whose range the match was held, and also a silver loving cup, to be retained by the school winning it for two successive years.

The team and the individual scores of the members in the championship match were as follows:

Fulton.....	466
Bailliere.....	453
Schnepfe.....	453
Loos.....	453
Hopkins.....	441
Porter.....	439
Preston.....	433
Thomas.....	425
Bevan.....	424
Sternberg.....	392
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Total.....	4,379

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#### POLO.

The polo team for 1910-1911 was composed of the following players:

Leilich, center; How (captain), first rush; Millar, second rush; Brown, cover point; Black, goal.

Substitutes: Greer, Moltz, Clemmitt, Hamill, and Hill.

The games played were as follows:

Polytechnic.....	9,	Calvert Hall.....	0
Polytechnic.....	2,	City College.....	0
Polytechnic.....	3,	Deichmann's .....	0
Polytechnic.....	10,	Calvert Hall.....	0
Polytechnic.....	6,	City College.....	1
Polytechnic.....	2,	Y. M. C. A.....	0
Polytechnic.....	5,	Calvert Hall.....	1
Polytechnic.....	2,	City College.....	0
Polytechnic.....	1,	Y. M. C. A.....	3

The interscholastic championship banner was awarded to the Polytechnic team for the second consecutive time.

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#### LAWN TENNIS.

The session of 1911 was the first in which lawn tennis was recognized by the Athletic Association as one of the athletic features of the Baltimore Polytechnic Institute. Mr. John H. Hills, of the teaching staff, acted as manager, assisted by Charles Burlingham. The team was composed of:

Dischler, Chew, How, Dix (captain), Troxell, Elliott, Porter, Chandlee, and Graham.

Summary of matches played:

With Maryland Athletic Club, Second:

Polytechnic.... 4 sets, Maryland Athletic Club..... 3 sets

With Johns Hopkins Freshmen:

Polytechnic.... 6 sets, Johns Hopkins University.... 1 set

With Baltimore City College:

Polytechnic.... 6 sets, Baltimore City College..... 8 sets

## CATALOGUE OF GRADUATES.

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### CLASS OF '87.

Clarence G. Bouis,  
George C. Bump,  
Lucien Dallam,  
Otto H. Ehlers,  
Osma K. Gardner,  
Herbert F. Gorgas,  
Joseph Greenbaum,  
Henry W. Hahn,  
Minor F. Heiskell,  
Robert Hooper,  
William S. Hugg,  
Thomas J. Irons,

Joseph H. Kuehn,  
P. Charles Nelson,  
Flavius J. Pennington,  
Richard Piez,  
Henry M. Price,  
Walter G. Reinicker,  
William A. Robertson,  
Albert Rosenberg,  
James B. Scott,  
Walter R. Sweeney,  
James C. Thompson,  
Adolphus Tiemeyer,

Frederick H. Wagner.

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### CLASS OF '88.

Arthur O. Badendrier,  
Edward Binswanger,  
Bernard H. Brooke,  
Sydney S. Bouis,  
Julius Fireman,  
Thomas G. Ford,  
George M. Gaither,  
John H. Harvey,  
Howard Harvey,  
Walter J. Herman,  
Joseph H. Hooper,  
John P. Jefferson,

William Johnston, Jr.,  
William Mencke,  
William F. Mylander,  
Edwin F. Orem,  
Edward B. Passano,  
George E. Repp,  
Harry E. Roberts,  
George C. Robinson,  
Hanson Robinson,  
Robert E. Rodgers,  
George H. Sickel,  
Washington B. Stanton,

Orlando C. Weeks.

## CLASS OF '89.

William F. Ackerman,  
 Samuel R. Adams,  
 Morgan H. Baldwin,  
 Arthur Gordon,  
 Ernest Griffith,  
 Isaac Behrend,  
 Joseph Isaac,  
 Louis H. Gerding,  
 Harry M. Ford,  
 Edward P. Cromwell,  
 John S. Hand,  
 Claiborne M. James,  
 Albert C. Layman,  
 Charles W. Leach,  
 J. W. C. Meikle,  
 Rozier L. Bouis,

Robert H. Buschman,  
 Charles C. Constantine,  
 Albert T. Barrett,  
 John L. Ehrman,  
 Allyn Field,  
 Howard Crosby,  
 George W. Moog,  
 John K. Mount,  
 Robert W. Peach,  
 Charles E. Phelps, Jr.,  
 William G. Robertson,  
 Robert C. Round,  
 Myron S. Rose,  
 William C. Siegmund,  
 Joseph Stiefel,  
 Harry P. Suman,  
 Carroll Thomas.

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## CLASS OF '90.

John F. Abendschein,  
 G. S. Barnes,  
 J. H. Bokee,  
 J. Edward Broadbelt,  
 W. H. Farinholt,  
 Chris. Feick,  
 J. Froelich,  
 William P. Gundry,

E. C. Harris,  
 J. C. Mattoon,  
 John D. Pugh,  
 A. O. Robertson,  
 William F. Schultz,  
 Michael D. Schaefer,  
 William P. Shriver,  
 Theodore Straus.

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## CLASS OF '91.

Walter Amos,  
 Basil Benson,  
 William Benson,  
 William Boucsein,  
 Morde Bren,  
 John J. Caine,  
 George Dannetel,  
 Charles Ehlers,  
 Ferdinand B. Keidel,

J. Edgar Knipp,  
 Samuel McNeal,  
 James C. Phillips,  
 Herbert M. Reese,  
 Edmund W. Robinson,  
 Reuben Row,  
 Warren S. Seipp,  
 N. D. D. Sollers,  
 Richard S. Warner,  
 William A. Young.

## CLASS OF '92.

Edwin W. Antes,  
John P. Baer,  
Frank J. Borie,  
B. Harrison Branch,  
Leonard Burbank,  
William C. Butler, Jr.,  
Frank B. Hooper,  
Edgar N. King,  
John Langford,  
Louis Liepman,  
R. M. Miller,

J. W. Dawson, Jr.,  
Royal R. Duncan,  
Charles R. Durling,  
Isidor Deutsche,  
Walter H. Eisenbrandt,  
William T. Holmes,  
J. C. Miller,  
Joseph Mullen,  
William H. Rose,  
Albert G. Singewald,  
William H. Soine,  
William E. Straus.

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## CLASS OF '93.

Theodore H. Ackerman,  
Herbert Addison,  
Oregon R. Benson,  
Percy Thayer Blogg,  
C. Raymond Carson,  
William John Cochran,  
B. C. D'Yarmett,  
Henry M. Fitzhugh,

Clarence S. Hand,  
James F. McShane,  
Clarence F. Morfit,  
F. H. Phelps,  
Edwin Schenck,  
John R. Uhler,  
L. Ismay Van Horn,  
Charles P. Weishampel,  
R. L. Williams.

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## CLASS OF '94.

Edward H. Bell,  
Albert E. Bowen,  
J. Straith Briscoe,  
Harry Cotton,  
Carroll Edgar,  
Frederick Kopp,  
Philip Littig, Jr.,  
Thomas Q. McGinn,

Herbert A. McGaw,  
Horace J. Miller,  
Louis Mueller,  
George M. Parlett,  
Charles Schlicker,  
Alan P. Wilson,  
John Zeubert,  
Pliny Cutler Hall,  
Edward J. Herring.

## CLASS OF '95.

George W. Brown,  
Clifton A. Coggins,  
Harry W. Francis,  
Graham B. Hall,  
William W. Hogendorp,  
Albert J. Hooper,  
Frank A. Hornig,  
Howard L. Hoskins,

Edward M. Likes,  
Ward P. Littig,  
Alfred F. Loeser,  
Thomas J. H. Magness,  
Herman F. Myer,  
George N. Rogers,  
Hamilton D. Ruth,  
Richard F. Weishampel,  
Carl A. Witthaus.

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## CLASS OF '96.

Samuel Hosea Armstrong,  
Howard Douglas Bennett,  
James Gomelia Boss, Jr.,  
William Augustine Boykin, Jr.,  
Robert Lemmon Burwell,  
Harry Parr Diggs,  
Frederick L. H. Glendmeyer,  
William Howard Hamilton,  
Arthur Worthington Hawks, Jr.,  
Fredk. Worthington von Stein,  
Louis Kemp Henninghausen,  
Harry Louis Homer,

Ludford Cohoon Jones,  
Leon Alvyn Kohn,  
Erich Albert Loeser,  
Henry Louis Mencken,  
Harold Vincent Patterson,  
Harry Clay Powell, Jr.,  
Gilmor Meredith Ross,  
Thomas Quincy Scott,  
Henry Bonn Silverthorn,  
William Henry Smith,  
Roscoe Conkling Sweeny,  
Charles Edwin Wilson,  
Olin Alexander Wilson.

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## CLASS OF '97.

Louis Fabian Bachrach,  
Alan Marion Bennett,  
William Melvin Carter,  
Elvin Griswold Cromwell,  
John Towson Elsroad, Jr.,  
John Montgomery Gambrill,  
Ernest Cummins Hatch,  
William Hain Kirwan,

Harry L. Kugler,  
Chester Waters Larner,  
Howard Osgood Preston,  
George Gottlieb Schnepfe,  
Frederick Lewis Schwartz,  
Joseph Stewart Smith, Jr.,  
Douglas Alan Sparks,  
Joseph Morrison Sparks,  
Wilson Ward.

## CLASS OF '98.

Thomas Jefferson Andrews,	John Walter McGreevy,
Alan Joseph Bachrach,	Edward Harris Mealy,
Leo Bauerfeld,	William Charles Metcalf,
Wilbur McKnew Bosworth,	John Floyd Miller,
Frederick Derick Dollenberg, Jr.,	William Eldred Nolan,
Romulus Griffith Doyle,	Gurdon Tyler Pollard,
John Howard Flayhart,	Walter Percy Poole,
Henry Galloway,	John Maurice Rehberger,
Charles Raymond Gantz,	John McCullough Rife,
Samuel Thomas Griffith,	Harry Rufus Ruse,
Alfred Cummins Hatch,	Paul Edward Schaun,
William Herman Hubers, Jr.,	John Henry Sirich, Jr.,
Joseph Lowrie Ingle, Jr.,	John Smith,
John Scott Longnecker,	Herbert Turner Snyder,
George Creamer Wilcox.	

## CLASS OF '99.

Charles E. Allen,	Harry Lowenthal,
William B. Boettinger,	George P. McCeney,
Harrison Brent,	William E. McCord,
Hugh W. Brent,	Marion H. McCoy,
Edward Goodnow Clayton,	Charles E. Mencken,
Edward P. Cooke,	Charles T. Owens,
Charles C. Crockett,	Edw. L. Schaun,
William W. Cushing,	Harold B. Vincent,
Arthur Councilman Davis,	Joseph A. Ward,
Charles H. Demitz,	Charles C. Lucke,
Roland S. Focke,	John N. McCleester,
Harry B. French,	Blakely A. McDonnell,
Robert B. Harper,	Edwin G. O'Connor,
Charles W. Held,	William Taylor Phipps,
Ira Johnson,	Emanuel J. Sedlacek,
George A. Knapp,	Frederick C. J. Sternat,
Walter B. Lang,	Joseph R. Walter,
William C. Whelan.	

## CLASS OF '00.

John Walter Fred. Blizzard,	Samuel Moore Johnson,
Roy Stevenson Houck,	Luther Chase Wright,
Galt Fayette Parsons,	Walter Bowen Buttner,
Gustave Frederick Linck,	Morgan Moore,
Horace Kirk Faust,	John Charles Masopust,
Thomas Osborn Wansleben,	Walter Groverman,
Lawrence Gunton Allbutt.	

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## CLASS OF '01.

Joseph M. Beehler,	Richard E. Marston,
C. Ernest Conway,	Harry Mehrling,
William M. Demitz,	John A. Raidabaugh,
Charles F. Goob,	T. Warden Rinehart,
Richard G. Harris,	William B. Rosenthal,
Irving C. Hess,	Edward Samuel,
Charles W. Hoppert,	John C. Siegle,
Carlisle L. Hubbard,	Walter H. Tapman,
Edward E. Johnston,	Sidney C. Vincent,
Thomas H. Kenny,	George P. von Eiff,
Charles E. Lane,	Ernest B. Walton,
Andrew J. Lowndes,	Arthur S. Weiss,
Ross E. Lynch,	George K. Yost,
Allen L. Malone,	Philip H. Zipp.

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## POST-GRADUATE CLASS OF '02.

(Four Year Course.)

Joseph M. Beehler,	Allen L. Malone,
C. Ernest Conway,	John A. Raidabaugh,
Irving C. Hess,	Sidney C. Vincent,
Andrew J. Lowndes,	George P. von Eiff,
Philip H. Zipp.	

## CLASS OF '02.

Joseph A. Baldwin,  
Frank O. Boyd,  
John B. Cautley,  
Robert Dall,  
William L. De Baufre,  
John K. Flick,  
Walter M. Gieske,  
Donald S. Hays,  
Joseph T. Henthorn,  
John S. Hess,

I. Seeley Jones,  
D. Frank Lamble,  
LeRoy M. Langrall,  
H. Quimby Layman,  
John G. M. Leisenring,  
William N. Michael,  
Charles A. Pettit,  
William S. Samuel,  
G. Forney Shryock,  
Charles F. Yardley.

## POST-GRADUATE CLASS OF '03.

(Four Year Course.)

John B. Cautley,  
Robert Dall,  
William L. De Baufre,  
John K. Flick,  
Walter M. Gieske,  
Donald S. Hayes,  
John S. Hess,

I. Seeley Jones,  
LeRoy M. Langrall,  
H. Quimby Layman,  
Specials—  
Arthur C. Davis,  
Charles A. Pettit.

## CLASS OF '03.

Elmer Armiger,  
Paul Backhaus,  
Oscar F. Benjamin,  
Owen C. Blades,  
Harry N. Brannan,  
Frank B. Burton,  
William N. Crisp,  
John W. Dorsey, Jr.,  
Christopher J. Frank,  
Milton H. Gross,  
Harold M. Parsons,  
Ernest M. Poole,  
J. McDonnell Reid,  
Martin J. Reynolds,

Edward Hering,  
Charles E. Herth,  
James B. Jones,  
Milton Kraemer,  
Herman Lucke, Jr.,  
Edmund C. Lynch,  
Arthur B. Marston,  
Harry M. Mason, Jr.,  
Sidney Newhoff,  
Manly P. Northam,  
August H. Schaaf,  
Howard I. Schultz,  
George F. W. Sims,  
Wilmer T. Stone.

## POST-GRADUATE CLASS OF '04.

(Four Year Course.)

Paul W. Backhaus,  
Harry N. Brannan,  
William N. Crisp,  
Edward Hering,  
James B. Jones,  
Milton Kraemer,  
Harry M. Mason, Jr.,

J. McDonnell Reid,  
Martin J. Reynolds,  
George F. W. Sims,  
Specials—  
Frank B. Burton,  
H. Milton Gross,  
August H. Schaaf.

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CLASS OF '04.

Chester A. A. Albrecht,  
James B. Arthur,  
Marion V. Bailliere,  
Joseph Bowes, Jr.,  
Andrew K. Brumbaugh,  
Clarence C. Clickner,  
Edward C. Cromwell,  
Frederick L. Dixon,  
Charles A. Edel,  
Frank B. Fifer,  
Emanuel Fritz,  
George Gittelsohn,  
J. Lyell Gressitt,  
Edward J. Hecker,  
John H. Hills,  
Harry J. Hodes,  
Benjamin F. Hoffacker,  
Harry V. D. Hunt,  
William C. Hurley,  
Charles A. Langrall,

Herman W. Lasser,  
Daniel J. Leary,  
Leon Marmor,  
Samuel May,  
John L. Mosher,  
Charles P. Niederhauser,  
Robert G. Pangborn,  
Massimo Pisani, Jr.,  
George S. Robertson,  
George M. G. Schaefer,  
Leon Small,  
Oscar E. Smith,  
Marion Steinberger,  
Harry D. Thurlow,  
Harry Waldorf,  
Charles W. Whittle,  
Edwin L. Willson,  
Louis A. Witte,  
William P. Wittmer,  
Alexander H. Woollen.

## POST-GRADUATE CLASS OF '05.

Chester A. A. Albrecht,  
 James B. Arthur,  
 Joseph Bowes, Jr.,  
 Edward C. Cromwell,  
 John W. Dorsey, Jr.,  
 Charles A. Edel,  
 Frank P. Fifer,  
 Emanuel Fritz,  
 J. Lyell Gressitt,  
 Richard G. Harris,  
 Edward J. Hecker,  
 John H. Hills,

Benjamin F. Hoffacker,  
 Harry V. D. Hunt,  
 Charles A. Langrall,  
 Samuel May,  
 John L. Mosher,  
 Robert G. Pangborn,  
 Massimo Pisani, Jr.,  
 Leon Small,  
 Marion Steinberger,  
 Harry DeG. Thurlow,  
 Harry Waldorf,  
 Edwin L. Willson,

Alexander H. Woollen.

## CLASS OF '06.

H. Roy Anderson,  
 Moses Appel,  
 Walter K. Bachrach,  
 Harry C. Becker,  
 J. Ralph Bolgiano,  
 William Wallace Boyd,  
 G. Herman Carl,  
 Willis B. Clemmitt,  
 Charles H. Dorsey,  
 George Erck,  
 Harry C. Finck,  
 Edwin Friese,  
 John R. Guttmann,  
 John R. Haswell,  
 Charles W. Henderson,  
 George F. Heubeck,  
 Ralph Holbrook,  
 Andrew C. Kemler,  
 Howard G. Lanahan,  
 George F. Lehmann,

Frank T. Leilich,  
 Harold M. Lewis,  
 Bernard A. McAbee,  
 Carl F. Meyer,  
 Sidney D. Mitchell,  
 Ferdinand Oppenheimer,  
 John G. Pertch, Jr.,  
 Lewis W. Porter,  
 John T. Ridgely,  
 John C. Schirmer,  
 Edward K. Stenbridge,  
 David B. Stewart, Jr.,  
 Levin H. Stewart,  
 Israel E. Stolberg,  
 Frank T. Suman,  
 Nicholas C. Thalheimer,  
 Raymond M. Weaver,  
 George F. Wennagel,  
 George F. Weighardt,  
 Phillip H. Williamson,

Walter B. Wills.

## CLASS OF '07.

Theodore Ascherfeld,  
Ludwig Aull,  
Emil G. Bauersfeld,  
R. M. Bealer,  
Alvin M. Bland,  
Gustave Bornscheuer,  
J. Daniel Brendel,  
John N. Childs,  
Wilmer A. Dehuff,  
C. Lehman Downs,  
Herbert S. Fairbank,  
F. Donald Fenhagen,  
Otto A. Geumann,  
Charles E. Grimes.  
Henry R. Gundlach,  
G. Herman Guttmann,  
Carroll R. Harding,  
William Hartman,  
Horace K. Hayden,  
Harry L. Hess,  
F. Merrill Hildebrandt,  
Fernando Janer,  
Harry B. Joyce,  
John P. Kenney,  
Charles Krausse,

W. H. Kruger, Jr.,  
William G. McLaughlin,  
Laurence F. Magness,  
J. C. Manning,  
Lawrence G. Miller,  
Charles E. Mitchell,  
Serafin M. Montesinos,  
George T. Mumma,  
Marcus Newhoff,  
Samuel P. Nixdorf,  
Arthur Norden,  
Edwin H. Nordmann,  
Charles J. Rasch,  
Charles J. Ritterhoff,  
Ernest Rodemeyer,  
Arthur H. Schultz, Jr.,  
Nelson Schuster,  
Frederick B. T. Siems,  
V. Bernard Siems,  
Charles Silver,  
Samuel F. Tapman, Jr.,  
T. Leonard Walter,  
Berdnard Wich,  
R. Mason Wilhelm,  
Julius Zieget.

## CLASS OF '08.

Otto E. Adams,  
Gelston H. Armstrong,  
Clarence P. Bolgiano,  
Gilbert F. Bolgiano,  
Emmet B. Bryan,  
Joseph D. Bullock,  
Nathan R. Butler, Jr.,  
Walter S. Byrne,  
James R. Carroll, Jr.,  
Thomas D. Conn,  
Percy Davenport,  
Franklin Davis,  
Arturo Diaz,  
Austen Gailey,  
Frank Goldenberg,  
Eugene E. Graham,  
T. Douglas Gresham,  
R. Milton Hall,  
Walter L. Heathcote,  
Walter F. Heise,  
Harry C. Hess,  
Harry W. Hill,  
Milton A. Hodes,  
Abraham A. Hollander,  
Henry J. Horn,  
Raymond H. Hoskins,  
Henry A. Israel,  
Wilbur C. Jackson,

Manuel Janer,  
Charles R. Justi,  
Laurence A. Kahn,  
Walter E. Lee,  
Andrew H. Lemmon,  
Frederick W. Lieberknecht,  
Thomas W. Manning,  
Richard C. Meyer,  
Robert E. Palle,  
Mitchell W. Price,  
James P. Ray,  
Norman G. Reinicker,  
Herbert B. Reynolds,  
Norman F. Rigor,  
Edwin Rolker,  
Raymon Schlegel,  
Christian Schluderberg,  
Othello Schroedl,  
Arthur G. Schuster,  
Otto Sima,  
Benjamin F. Starr, Jr.,  
Milton D. Swartz,  
Walter M. Troll,  
Henry Vogt,  
Romaine G. Waltenberg,  
Carl C. S. Walter,  
Luther Chase Wright,  
Frederick A. Zscheuschler.

## CLASS OF '09.

Frederick B. Abbott,  
 Oscar M. Bloch,  
 George C. Borst,  
 Frederick Burggraf,  
 Carlton D. Cann,  
 Douglas C. Corner,  
 Harry W. Crist,  
 William Dalrymple,  
 Luis A. Deliz,  
 Frank Fahm, Jr.,  
 Clarence J. Flayhart,  
 Roy D. Fleckenstein,  
 George C. Fultz,  
 H. Nelson Gambrill,  
 Wilson N. Gambrill,  
 Rafael Garcia,  
 G. Stewart Giles,  
 John Glaeser, Jr.,  
 William T. Hanzsche, Jr.,  
 Elmer Heubeck,  
 Walter E. Higham,  
 James R. E. Hiltz,  
 William Vernon Hipsley,  
 Franklin E. Holland,  
 Adam W. Jahn,  
 Arthur Janushek,

Ernest F. Knabe,  
 Roger C. Knipp,  
 Gibbs LaMotte,  
 William D. Lambdin,  
 G. Bernard Lohmuller,  
 William J. Mason,  
 R. Brooke Maxwell,  
 Henry C. A. Meyer,  
 Julius O. Mirski,  
 Emory H. Niles,  
 Walter F. Perkins,  
 Frederick L. Purdy,  
 Herbert C. Randall,  
 Paul Rosenthal,  
 G. William Schindhelm,  
 D. William Schilling,  
 Harry B. Siegmund,  
 Ernest Southerington,  
 John Snyder,  
 Frederick C. Stauffen,  
 William F. Tapking, Jr.,  
 Leroy K. Thompson,  
 H. Belin Tinges,  
 Manuel L. Vincente,  
 Herbert L. Weaver,  
 Bertram S. Winchester,

J. Edward Yewell.

## MID-YEAR CLASS OF '10.

George E. Gerlach,  
 George E. Green,  
 Frank Herrmann, Jr.,  
 E. M. Kennard, Jr.,  
 Alfred Mullikin,  
 Alfred Nisbet,  
 Carl K. Schulte,

John Louis Siems,  
 Morris Arthur Spamer,  
 George J. Sturmfels, Jr.,  
 Wilbur Nicholas Van Sant,  
 Philip Waldschmidt,  
 John F. Wannenwetsch,  
 Russell D. Welsh,

C. A. Yockel.

## CLASS OF '10.

Robert E. F. Aler,	Charles W. Miller,
William H. Barnard, Jr.,	William N. Neibich,
Ralph G. Bittle,	Dudley F. Nicholson,
Leo Blankman,	Frank Neumann,
Jacob Blaustein,	John B. Norris, Jr.,
Howard F. Carr,	Edgar Parrish,
Laurence B. Chenoweth,	Abbott L. Penniman,
Herbert A. Ehrman,	Ferd. H. Plack,
Ernest W. Eickleberger,	Edwin A. Plitt,
Franklin C. Eleder,	Henry R. Rausch,
George B. Farlow,	Charles M. Reed,
George E. Finck,	Richard G. Reese,
Charles V. French,	Arthur Rhoads,
August P. Gompf,	John K. Ruff,
Carroll T. Harris,	Albert H. Samuel,
Parr Hooper,	Henry F. Schneider,
Charles R. Johnson,	Jacob Schmidt, Jr.,
George Johnson,	L. Wilson Scott,
William B. Johnston,	Charles L. Steel,
Edwin F. Koester,	George W. Tall, Jr.,
Robert W. Kroeger,	Perry M. Teeple,
August J. Kutzleb,	Carroll A. Turner,
Joseph H. Letzer,	Leo Tyser,
Lewis W. Link,	Charles P. Vogel,
Thomas M. Linthicum,	M. Leeson Walsh,
Edward D. Lynch,	Frank I. Wheeler,
Howard B. Lyon,	F. Carey Williams,
William E. McComas, Jr.,	John A. Woodfield,
Louis Mardaga,	P. Chancellor Wroe,
Eugene D. Milener,	Roy A. Yingling.

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CLASS MEMORIALS.

Framed portrait of DR. HENRY A. ROWLAND. Presented to the Institute by the Fourth Year Class of 1903.

Framed picture illustrating the Bessemer process. Presented by the June Class of 1911.







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